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GEOLOGY.

THE NIOBRARA GROUP.

BY CHAS. H. STERNBERG.

The rocks of Cretaceous No. 3, or Niobrara group, consist of an upper stratum of red, yellow or white chalk, underlaid by great beds of blue shale. There is no paleontological difference between the strata, as the same animal remains are found in both. These beds are of great value to science, as they contain the remains of animals that once inhabited the cretaceous ocean. Perfect skeletons are found of huge saurians eighty feet in length. What a field for the imagination of the student, to people the old cretaceous seas with animals restored from their buried relics! I now in imagination walk the old cretaceous beach; I hear the rush of mighty rivers, as, laden with the *debris* of the carboniferous hills, they pour into the ocean, depositing their loads of soft mud that is to cover and preserve the remains of animals living in these waters. Far out at sea, I "observe a huge snake-like animal, with head erect, full twenty feet in air, gazing into the depth below." The fish that meets his eye will soon fall a victim to his voracious appetite. Another monster of the deep grandly exposes a length of eighty feet; as he lies stretched on the waters an enemy in the distance attracts his attention and he prepares to offer battle; his four powerful paddles begin to work, and that vast mass of animal life commences slowly to move; gradually it gains more speed as the paddles move more rapidly; his huge tail, acting like a screw propeller of some steamboat, augments his speed and guides him toward his prey. The water boils behind him. It matters not how large the animal may be that he

means to attack, if once it receives a stroke from the powerful bony snout of our saurian (for he means to use it as a battering ram), it will lie a crushed and helpless mass upon the surface and the bubbling waters will suck it in; on the bottom of the ocean it will be dragged hither and thither by sharks and other rapacious fishes which will have many a dainty feast from its body. The soft mud of the ocean's bed will at last cover and bury the skeleton and preserve it for ages; future explorers will gather up and admire the finely marked bones for the attachment of muscles. A fleet of smaller saurians heave in sight; they twine their long delicate necks together or dive beneath the surface for some luckless fish, which, on again appearing, they hold in their long glistening teeth. "The air is darkened by great flying saurians that flap their leathery wings over the deep," or dive in pursuit of prey. As evening approaches they flock to the shore and suspend themselves by their claw-armed fingers to the cliffs. Wandering along the shore, I find that a huge fish, twenty feet in length has become entangled in the shifting sands of a shallow bay. It seems to be in agony, and, seeking the cause, I find it has been pierced by the long bony snout of some smaller fish that uses this weapon as the sword-fish of modern oceans does his sword. The beach is strewn with large oyster-like shells, twenty-seven inches in diameter. "They seem to be the remains of a feast of some titanic race."

As the explorer approaches the beds of the Niobrara Group, he often sees in the distance a city of imposing grandeur. Wide streets, lined with buildings of dazzling whiteness meet his eye, and only a near approach will convince him that he is looking at nature's handiwork. The rains of ages have cut and fashioned the soft limestone into the semblance of cities. The shale beds of this formation contain great quantities of the salts of soda and magnesia and the waters flowing from or through these beds are strongly impregnated with "alkali." They also contain iron pyrites and gypsum. I have often, while wandering along some wash (where the chalk and shale has been denuded), found some fossil bones scattered along, and by following them up to where bones project from bluff or bank, I find I have stumbled upon the burial ground of a denizen of the ancient cretaceous seas. Perhaps it is a species of *Leiodon* and reaches a length of eighty feet. Its long teeth glisten in the sunlight, and its powerful paddles reach far in the bluffs on either side, requiring days of toil to lay them bare. The great bony snout (the characteristic of all his race), which, with other peculiarities, places him in Cope's new sub order of *Pythonomorpha*, lies pointing heavenward. I find that he is without an expansible gullet, as in modern serpents; another method of swallowing his food whole is given him, as witnout it he could not exist, as he has no teeth for masticating, and I find that the jaws are provided with a set of hinges, of ball and socket pattern, just back of the dentary bone. He is thus enabled to expand the cavity of the mouth. All now that was necessary to allow the passage of large morsels into the stomach, was a loose, baggy, pelican-like throat, with which he was doubtless provided. His teeth were long and conical, slightly recurved; his head long and conical, with eyes directed upward. He, perhaps, had the faculty of flattening his head like the python.

One peculiarity of the order is found in the quadrate bones, which not only places him in the rank of reptiles, but enables the student to distinguish from it the different species. In shape this bone resembles the external ear of a man, and is composed of the bones that help make up the internal ear in mammals. This bone connects the under jaw with the skull and allows all the motion necessary. His tongue was long and forked, like a serpent's, and was thrust out while in motion. The only noise he could make was a hissing sound. While at rest, "the tongue was concealed in a sack under the windpipe." *Leiodon proriger* Cope, reached a length of eighty feet; it had a long slender neck, twenty feet in length; the tail was long and powerful, and was doubtless used both as a rudder and propeller. *Clidastes tortor* was an elegant creature, about forty feet in length; its vertebral column was provided with an additional set of articulations, so as to enable it to coil itself like a snake; this seems to be its favorite position, as I have often found it thus coiled.

Clidastes pumilus, Marsh, was a little creature, ten or fifteen feet long, and doubtless often fell a victim to the larger saurians or rapacious fishes with which the cretaceous seas abounded. The Pterodactyls of the Niobrara differed very much from those of Europe; they were much larger; I have found them with an expanse of wing of twenty-five feet; they were also without teeth, and Marsh has made the new genus *Pterodon* for them. One peculiarity of the Niobrara group is the presence of the only known birds armed with teeth.

Icthyornis dispar, Marsh, was a bird six feet in height; it was armed with long sharp teeth; the wings were poorly developed; they were swimmers and lived on fishes. Other birds are found no larger than a dove; they are arranged in families according to the position of the teeth, which are placed either in grooves or sockets. Believers in the evolution theory have received the discoveries of reptile-like birds as a positive proof that they have descended from reptiles. Of all the strange animal forms found in the rich fossiliferous beds of western Kansas, I think Cope's *Protostega gigas*, or marine tortoise, is the most unique. Cope calls them the boatmen of the cretaceous ocean.

In 1877 I discovered a specimen that measured twenty feet from one flipper to the other; the distance between the condyles of the lower jaws was eighteen inches. We know that in modern turtles the young, when first hatched, have free ribs like other animals, and that in process of growth, bone is deposited in the skin, the ribs expand and unite in connection with the breastbone, forming a perfect shell, or house. This is not the case in *Protostega*; in the adult the ribs are free, and, in place of a shell, these animals are provided with great dermal plates, two feet in diameter, an inch thick in the center and beveled off to a thin figured margin. When Prof. Cope discovered this animal, he was confident he had found a young turtle, but it was impossible to believe that an animal measuring twenty feet from flipper to flipper had just been hatched, and on studying the bones he was forced to conclude that it was a full grown animal, and to be one of those miniature types that is often found in the geological strata—another fact taken by many to prove that animals of the present day have been derived from

more imperfect species, which, by process of growth, have obtained the perfect condition in which we find them.

Great oyster-like shells are found in the Niobrara called by Conrad, *Haploscapha*. They often measure twenty-seven inches in diameter and are usually covered with small oyster shells, *ostrea congesta*. Among fishes the first resembling our common edible species are found. The species that leads them all in point of size and ferocity, is Cope's *Portheus*.

P. molossus was twenty feet in length. It was provided with a huge bulldog shaped head with fangs projecting from the mouth four inches. The roof of the mouth and lower jaws were covered with teeth irregular in size—some long and conical as the ones mentioned; others much shorter. These huge fishes were also provided with other means of defense or attack in the shape of great bony spines, with one edge enameled, that, even in their fossilized forms, are hard and sharp enough to be used in cutting wood. In some species one edge is toothed. They are often three feet in length and are made up of bundles of rods which terminate in the sharp teeth of some species, or are beveled down to make the sharp edges of others. I have no doubt but that these enormous fishes would not hesitate to attack their neighbors, the saurians. They were certainly well provided with weapons, for, in addition to the ones mentioned, their tails were forked and made up of bundles of hard bony rods, and, I imagine, a blow from this would disable an antagonist easily. Another peculiar species found in Western Kansas is the snout fish, or Cope's *Erioiethes*. Though small, not over five or six feet in length, its bony snout, six or eight inches in length, must have proved a terrible weapon. I discovered three new species, of this genus in 1877. We have also the *Enchodus*, a fish with teeth, one on each premaxilla, that were shaped like the incisors of a beaver. Sharks abounded; I have often found their flat coin-like vertebra and delicate serrate edged teeth. One species of this family are provided with teeth covering the roof and floor of the mouth, which were doubtless used as a mill for grinding up food. Some beautiful crinoids were found by Prof. Mudge's party in the rocks of this formation. A company has been organized at Trego, Kan., for the purpose of utilizing the chalk by making waterproof cement—said to be equal to the best Portland cement. Great quantities of iron pyrites and gypsum are found. The rocks are of little value for building purposes, although it has been used in making the buildings at Ft. Wallace, with the belief that they would harden when exposed to the atmosphere, but they are as soft now as when the buildings were first made. Near Wallace, however, builders can draw from the conglomerates of the Loup Fork Group, which are found on the high lands near by.

I am greatly indebted to Prof. E. D. Cope's Cretaceous Fauna, from which I have drawn largely in the preparation of this paper, as I could obtain many facts from no other source. I hope he will pardon the use of some of his descriptions.

THE ICE PROBLEM IN COLORADO.

BY CAPTAIN E. L. BERTHOUD, GOLDEN, COL.

In February, 1876, the *American Journal of Art and Sciences* published a short article on the existence of "rifts of ice in the rocks near the summit of Mt. McClellan, Colorado." In that article I have described and shown that in Mt. McClellan the whole mountain is permeated throughout with veins of ice running through the broken up rock, which is rich in veins of argentiferous galena and gray copper; that this condition extends over 500 feet in depth on the face of mountain, while immediately opposite, at about 12,400 feet above the sea, *Pinus Aristata* of large size grows thriftily. Since 1878, I have resided for several months at the north side and at the foot of Mts. Grey and McClellan and westward six miles to the summit of Loveland Pass, an altitude of 11,876 feet, but have nowhere, except at the Stevens mine, found an equal development of this icy condition.

In 1874, Prof. Weiser, in the same journal, suggested that the frozen soil and rock found by him on the west and northwest slope near and on McClellan Mountain, "were fragments of the glacial period, thus left ice-bound from their excessive altitude."

I considered this doubtful, and in the article written in 1876, I concluded that this frozen condition is more probably due to local causes, and that it is not a fragment of the glacial period. Prof. Devor introduced this subject in France at a scientific reunion, and is inclined to side with Prof. Weiser's theory. But another fact remains yet unanswered in this connection: How is it that large pine trees grow in the valley northeast from Mt. McClellan at an altitude near 12,400 feet above the sea, or 1,300 feet higher than on Grey's Peak, five miles southwest, and fully 600 feet higher than at the Loveland Pass.

In reference to this subject of tree growth on high altitudes, in 1878–79–80 I have observed in the Rocky Mountains, between Long's Peak on the north to the Sawatch range, west of the Arkansas, that whenever we arrive at from 10,400 to 11,000 feet altitude, we find that our mountain forests are composed almost wholly of *Abies douglassii* and *Abies balsamea* or balsam fir. These lofty forests of spruce and Canada balsam flourish best where the northerly slopes retain our deep winter snows the longest season in the spring; and, strange to say, the largest trees invariably are those that we find at the greatest altitude, even up to 11,800 feet, where I have measured *Abies douglassii* over five feet in diameter. In these highest forests all the trees are grown up or have passed their maturity, and have an appearance indicating a long passed period of maximum growth. We find there no new growth of young trees; the ground is covered by low whortleberry bushes, with an occasional yew or juniper bush; and in the many open glades, flowers of colors bright and lovely. The whole facies of these elevated forests breathe age and maturity that has reached and passed culmination. When destroyed by fire or the axe of the dendrophagous sawmill man, or miner, no new growth of the coniferæ take their place—they have no progeny.

Can we conjecture that originally the present lofty valleys enjoyed a climate more fitted for the growth of large forest trees, or are they the last fragment of a growth that, before the present elevation of our mountain range, flourished at lower altitudes in a better and longer period of summer months.

To better elucidate this subject, we will give a brief altitudinal catalogue of the tree growth of our Rocky Mountain range in Colorado, from 5,000 feet altitude in the South Platte valley, to the utmost limit of arboreal vegetation at 12,400 feet, in Argentine Gulch, near the Argentine Pass, 13,100 feet altitude.

LAT. 39° 45′ N.—PRAIRIE DIVISION.

From 5,000 feet altitude at South Platte river to 5,400 feet, entrance Table Mountain Cañon, on Clear Creek:

Populus monilifera,	Sweet Cottonwood,
Negundo aceroides,	Box Elder,
Salix nigra,	Black Willow.

Within two miles of the cañon we find about the last sweet cottonwood. Its place is now taken by the bitter cottonwood, or narrow-leafed cottonwood *Populus angulata*.

LAT. 39° 45′ N.—FOOT HILL DIVISION.

Altitude from 5,400 to 6,000 feet, limit of wild grapevine—*Vitis*.

TREES.

Populus angulata,	Bitter Cottonwood,
Populus tremuloides,	Quaking Asp,
Negundo aceroides,	Box Elder,
Celtis crassafolia,	Hackberry,
Juniperus communis,	Red Cedar,
Abies douglassii, (very few),	
Pinus aristata,	
Abies grandis.	

CANON DIVISION.

Latitude about 39° 44′ to 39° 38′. Altitude from 6,000 ft. to 10,000.

Pinus Aristata,	*Abies douglassii*,
Abies grandis,	*Pinus balsamea*,
Populus tremuloides,	*Populus angulata*,

Juniperus communis.

TIMBER LINE DIVISION.

From 10,000 feet to 12,400 feet.

Pinus aristata,
Pinus Engelmanni; or *Flenilis?*
Pinus balsamea, begins at 9000 feet altitude.
Abies douglassii.
Populus tremuloides, scarce.

PICKETT'S SILURIAN CAVE.

BY H. C. HOVEY.

Every one who visits Colorado is surprised at certain features of scenery to be accounted for only by considering the peculiar geological structure of the region.

The vast plains, sweeping from the Missouri Valley westward to the foot-hills of the Rocky Mountains, have a gradual upward slope from an altitude of only 770 feet above the sea, at Kansas City, to an elevation of 6,000 feet, at Colorado Springs. The underlying rocks, resting on one another, in broad sheets, are varieties of sandstone, limestone, slate and shale, mostly belonging to the cretaceous formation.

A glance at the geological map of Colorado shows that large areas of the mountain region are marked as "eruptive," which means that, at some period later than the formation of the plains, there was a great upheaval of the earth's crust, causing the lower rocks to appear at the surface, sometimes by volcanic violence, and at others by the slower process of denudation. These rocks are granite, gneiss, trap, and other hard species, capable of resisting the ordinary action of the elements.

Along the border line, between the plains and the mountains, is a comparatively narrow but highly interesting region, lying nearly north and south, where the rocks of the plains, instead of being flat, are turned upward and broken off by the same force that lifted the mountains themselves. It is the opinion of the geologists that these sedimentary beds once extended much further up the mountain side than now, being gradually worn down by the retreating waters of the primeval ocean, and the subsequent erosion by running streams.

One of my summer vacations, not long ago, was spent amid the mazes of this border land, and I found it a geological paradise, where the explorer may, by guiding his course intelligently, cross the edges of all the strata, from the Archæan rocks to the Tertiary, studying the entire history of their folding and erosion, to better advantage, perhaps, than anywhere else on the continent.

The Monument Group of red sandstones has been repeatedly described by pen and pencil. The fanciful columns of loosely cemented sandstone, each capped by a layer of tough ironstone, that are, in Monument Park, only 10 or 20 feet high, rise to lofty castellated forms in the Garden of the Gods and Glen Eyrie, some of the needle-like spires shooting 300 feet above the green meadows at their base. These grotesque pillars are produced not only by the flowing water, but by the cutting action of whirling sand blown about them by the dry winds of summer.

Frequently, instead of standing in isolated masses, the red sandstone runs in ribs parallel to the chain of adjacent hills. These ridges are cut through at intervals by arches, gateways, caves and tunnels, with very picturesque effect.

The width of this border region varies from one to twelve miles. Nearest

the Granite Hills its rocks seem to have been sufficiently modified by heat to acquire an obscure columnar structure, thus opening lines of weakness, which have been sought out by the water, aided by insinuating roots and the power of frost, until one columnar mass after another has been pried off and finally removed by the further action of the elements. This process results in a deep and narrow valley known as a cañon.

Hundreds of cañons are found in various parts of the Rocky Mountain region, some of which are of enormous dimensions. But those visited by me lie along the course of Fountain Creek, at the base of Pike's Peak, and are interesting aside from their wonderful scenery, because affording such an excellent opportunity to examine not less than 4,000 feet of sedimentary rocks. In many of them the torrent had plowed down into the underlying feldspathic granite, giving an amazing exhibition of aqueous energy.

Williams' Cañon, near Manitou, was the last one visited, and on some accounts, I found it the most interesting of all.

The mouth of this cañon is cut through the red sandstone to a limestone, at first yellowish and sandy, but improving in quality as one goes deeper into the gorge, until it is of a good quality for all purposes to which limestone is ordinarily put, and large quarries have been opened, to which a wagon road leads.

The walls rise for 400 or 500 feet on each side, in many places absolutely perpendicular, and sometimes so close to each other that both wheels of the lime carts graze the walls in passing.

I found but few fossils, and they seemed to belong to the Silurian formation; a conclusion verified by Hayden's report, which speaks of these beds as being decidedly referable to the Silurian group. Prof. Hayden adds: "I have never known of any Carboniferous fossils being found here, but am confident that there are 1,000 to 1,500 feet of these beds between the Silurian and Triassic."

On his geological map, 1876, he assigns a portion of these rocks to the Carboniferous, and also marks high ridges of Silurian limstones on the side of the mountain about four miles north.

The existence of heavy deposits of nearly homogeneous limestone under circumstances so favorable for excavation, excited my curiosity as to the existence of caves in that locality. But after following the cañon for two miles or more, toward its head, nothing of the sort presented itself, except an open gorge, to which visitors had given the name of "The Cave of the Winds."

An entrance was discovered, last June, through this very gorge to a cavern of large dimensions, named for the boys who found it, *Pickett's Cave*, and described by Rev. R. T. Cross in the *Congregational News* for March, 1881.

Some progress in underground research was made last fall by an organization known as "The Boys' Exploring Association," of which the young Picketts are members. They found numerous obstructions, but noticed in one of the rooms entered a peculiar chimney-like aperture nearly closed by dripstone.

Through this chimney a passage was forced, last January, by Messrs. Reinhart & Snyder, who now own the cave. They found at its upper end a spacious

hall about 200 feet long, decorated with a profusion of stalactitic formations, in some instances translucent, and in others varying in color from red to pure white, sometimes coated by delicate frost-work.

A canopy was observed on one side of this hall perforated by the rotary action of water, near which was a pit partly filled, on whose sides there were singular markings caused by calcareous deposit from the evaporation of water.

Crawling for thirty feet through an "auger hole," admittance was gained to a series of rooms containing many curious and beautiful objects, including a set of *musical* stalactites.

Through a deep pit they descended by means of a rope into other apartments; while to reach others still, they had to climb steep acclivities, or worm their way through passages nearly filled with *debris* or obliterated by dripstone.

Forty rooms in all have thus far been explored; and, according to the account given, the attractions increase as exploration penetrates the mountain side. Shining crystals, tufts of satiny fiber, slender arms mimicking growths of coral, rams' horns twisted and intertwined in every conceivable way, pillars and pendants, statuettes and grotesque resemblances of life, are among the charms of these enchanted halls.

Vandals have, of course, despoiled the rooms first opened, and the discoverers had a right to take a few choice specimens to be placed in college cabinets, where they could be seen by the public. But now we are pleased to see that the rules forbid any one taking specimens, or even entering unaccompanied by a guide.

It is stated that "after entering the cave it takes about two miles of travel to explore every part of it." But the proprietors are building stairways and enlarging the narrow places, so as to enable visitors to go the round without serious fatigue. They promise also to improve the wagon road to a point near the cave, and to make steps up the wall of the cañon, to facilitate the ascent of nearly 200 feet that has to be made at an angle of 40° to gain the entrance to this subterranean realm.

If Pickett's Cave is, as I infer, excavated from Silurian limstone, that itself is a remarkable circumstance; for some of the most celebrated geologists in America have recently expressed "grave doubts whether in a single case Silurian caves extend much beyond the light of day." I have, in previous articles in the *Scientific American*, referred to Hanover Cave, a mile and a half long, and Howe's Cave, three miles long—both of them Silurian caves; and now we may add Pickett's Cave, said to be two miles in length.

It must be admitted that such cases are exceptional, the rule being that most Silurian caves, at least such as I have examined, are considerably wider at their entrance than at any point within.

It also remains to be ascertained if Pickett's Cave really is in Silurian rocks, or pierces through to the Carboniferous formation, famous the world over for its cavernous structure.

Further particulars may be given as new discoveries are made. But it can_

not be doubted that one more great attraction is added to the wonderful region that boasts of Monument Park, Glen Eyrie, the Garden of the Gods, Manitou Springs, Pike's Peak, and other glories all within a radius of ten miles.—*Scientific American.*

PHYSICS.

THE PHOTOPHONE EXPLAINED.

BY J. MUNRO, C. E.

The last five years have given to the world three extraordinary inventions, the telephone, the phonograph and the microphone. They are all concerned with sound, and are in reality aids to our powers of hearing. The telephone enables us to hear sounds, especially the human voice, at a great distance; the phonograph permits us to record speech directly without the use of letters, and to reproduce the original words; and by the microphone we can magnify minute sonorous tremors till they come within the range of our hearing. Moreover, they are not only allied in their uses, but in their origin, for the phonograph was suggested by the telephone, and the microphone could not have been discovered had the telephone not been first invented. To these three marvelous instruments we have now to add a fourth, which, in a still more striking manner, is the offspring of the telephone. This is the photophone or "light sounder" of Professor Graham Belland Mr. Sumner Tainter.

In the speaking telephone, as is well known, the sound waves of the human voice are caused to strike upon a thin diaphragm and set it into sympathetic vibration. This vibration also acts upon an electric current, so as to vary the strength of it in a manner corresponding to the sound waves of the voice, and by leading this current along a telegraph wire and then by reversing the process so as to make it set a second diaphragm into audible vibration, we are able to transmit speech to a distant place by wire. There the electric current is simply the swift medium for conveying the sound from one place to the other, and it does so in virtue of the undulatory character impressed upon it. We might reasonably ask, then, if nothing else will do instead. A ray of light travels through the air with still greater velocity than an electric current along a wire. Are there no means whereby an undulating beam of light can carry sound? Professor Bell has shown us that there is, and taught the "golden silence" of the sunshine to laugh and sing and speak.

The suggestion of the Photophone occurred to Professor Bell in the winter of 1878, when he was lecturing at the Royal Institution. There is a substance named selenium, which is peculiarly sensitive to light, for when a ray of light

falls on it, an electric current will more readily flow through it than when it is kept wholly in the dark. If then, we make the current to flow at the same time through a telephone, the impact of the ray of light on the selenium will cause such an increase of the current as will be audible in the telephone. Again, the cutting off the light will so diminish the current as to sound the telephone, and thus, as Professor Bell remarked, it will be possible

"To hear a shadow fall
Athwart the stillness."

Moreover, the stronger the ray of light, the less is the resistance which it offers to the current, and hence it follows that an undulating beam of light will set up corresponding undulations in the current, and these in turn will generate vibrations in the telephone which may be heard aloud. Obviously, therefore, if we could devise an apparatus by which the sound waves of the voice could undulate a beam of light in sympathy with themselves, and project this beam to a distant place where it could be received on a piece of selenium, through which a current flowed on its way through a telephone, we should be able to reproduce the original voice in the receiving telephone.

At the very beginning of his attempt he encountered serious difficulties. The intractable nature of selenium baffled all his efforts. This ambiguous material, which, like phosphorus and sulphur, is neither metal nor non-metal, was accidently discovered by Berzelius, the great Swedish chemist, when he was groping for something else—tellurium—and the foundling has proved to be the more important substance of the two, for owing to its singular property of electric sensibility to light, it has been chosen from among its humbler brethren and lifted into honor.

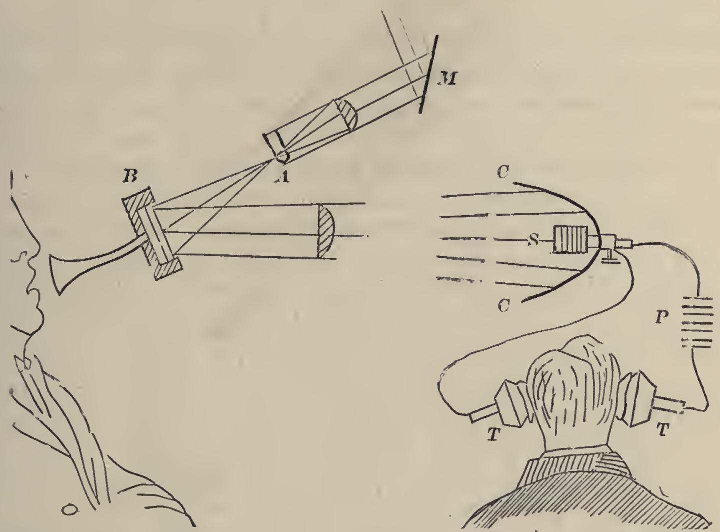
The striking effect was eagerly investigated by a number of scientists, who all agreed in referring it to the action of light, and the yellowish-green rays of the spectrum were found by Prof. W. Grylls Adams to be the most potent to produce it. Mr. Robert Sabine demonstrated that there was a real diminution of the internal resistance of the selenium under the influence of light; but Prof. Adams also showed that the observed increase of a current flowing through the substance was not entirely due to its loss of resistance, but to the actual generation of a current in the selenium. This fact is a very important one, and will, perhaps, find its use hereafter in the transmission of optical images by eleetricity. For the purpose of the photophone, however, the diminution of internal resistance under light is the main consideration. Dr. Werner Siemens found the decrease to obey a definite law. It is proportional to the square root of the intensity of illumination, and upon this basis he constructed a "photometer," or measurer of light.

This interesting apparatus is known as the "Selenium Eye." It consists of a hollow ball of blackened wood, formed of two halves which can be opened or shut like the lids of an eye. A little within the ball is placed a glass lens to focus the light which enters by the parted lids upon a sensitive selenium cell no bigger than a wafer, fixed at the back of the ball. From this organ two fine platinum wires lead to a voltaic battery and a delicate galvanometer. The current from

the battery flows through the selenium cell and the galvanometer at once, so that when a ray of light falls on the selenium and diminishes its resistance, the current increases in strength, and the needle of the galvanometer indicates the change upon a graduated scale. The deflection on the scale thus becomes a measure of the diminution of resistance, and hence of the intensity of the ray of light. There is a wonderful, nay, fearful likeness between this curious little instrument and the human eye. The movable eye-lids or shutters are present in both, as well as the crystalline lens, while the selenium cell with the conducting wires, voltaic battery, and galvanometer, are paralleled by the optic nerves and the brain. Moreover, there is another similarity which is fatal to the use of the "selenium eye" as an exact photometer. After exposure to the light repeatedly or for some length of time, the selenium cell loses its sensibility to light, and the galvanometer does not respond so strongly as before. The selenium, in fact, becomes fatigued, and, like the living eye, requires to rest ere it regains its former power. This tendency to physical fatigue was one great difficulty which Prof. Bell had to contend with in adapting selenium to the photophone. Another drawback which he had to overcome was the variable and uncertain nature of that body. Selenium occurs in two forms, the amorphous or vitreous, and the crystalline or metallic form. In the vitreous condition it is a non-conductor of electricity, in the crystalline state it is a conductor, but it has a fickle way of passing from the crystalline into the amorphous form, so that its resistance is apt to vary in an unexpected manner. Professor Bell found it best to crystallize it by annealing it in a crucible at a temperature of 210° centigrade, for 24 hours, and then allowing it to cool for 60 hours. With conductive selenium thus prepared, he constructed his photophonic cell for receiving the transmitted light.

This device combines a low resistance of the selenium with a large receptive surface. It consists of a number of round disks or "washers" of brass, about two inches in diameter, arranged side by side on axles, but separated from each other by disks of mica of slightly less diameter. These are clamped together in close file, and the grooves formed between the edges of the mica and brass are filled up with melted selenium, which is then annealed in the manner described, and the surface of the whole turned smooth in a lathe. The alternate brass discs are connected together, the first to the third and fifth, the second to the fourth and sixth, and so on, so as to give a circuit through the selenium surface, the battery and a receiving telephone. A double cell of this construction is then placed in the focus of a silvered reflector of parabolic contour, and the photophone receiver is complete.

The illustration represents this reflector, C C, with the cell, S, in the focus, and the requisite attachments of battery and telephones. The transmitting apparatus consists of a mirror, M, reflecting a beam of sunlight through a lens, and (if for the sake of experiment it is desired to cut off the heat rays) likewise through a cell, A, of alum water upon the transmitter, B. This is simply a diaphragm of thin flexible glass, silvered on the outside to reflect the light, and fitted into a frame which carries an india-rubber tube and mouth-piece, permitting a person to



speak against the back of the glass. A second lens, R, interposed in the path of the beam of light after it is reflected from the mirror, renders the rays parallel, and they travel in that condition until they are focused by the receiver, C C, upon the selenium cell, S.

In sending the photophonic message, the sound-waves of the speaker's voice put the silvered diaphragm into vibration and undulate the beam of light, which on reaching the receiver varies the resistance of the selenium in a sympathetic mode and reproduces the original voice in the telephones, T T. at the listener's ears. When sunlight is not available, the electric light may be employed, but it requires to be obtained from a very steady lamp, else the flickering will be audible in the telephone as a crackling sound which tends to drown the voice.

It is obvious that the photophone is the perfection of the heliograph, just as the telephone may be regarded as the perfection of the telegraph. But in each case the crowning instrument has a shorter range than its cruder forerunner. The telephone is dumb on the long wires which readily convey the signals of a telegraphic message, and the photophone would fail to speak over the great distances which are intelligibly bridged by the flashes of the heliograph. Nevertheless, it will be possible to photophone for a considerable distance, and even thus early Prof. Bell has succeeded in speaking along a beam of light 830 feet long.

This feat proves that the photophone will yet be employed in military tactics, and probably also in correspondence between ships at sea, or perhaps between a shipwrecked vessel and the shore. Moreover, light will penetrate water, and we can even suppose a submarine photophonic talk. The method is, of course, in its infancy, and will doubtless be perfected in course of time. Already it has realized to some extent the far-reaching truth of the poet, that "light is the voice of the stars." For the changing brightness of the photosphere produced by solar

hurricanes has revealed itself to Prof. Bell and M. Janssen in the photophone as feeble echoes, like the murmuring noise due to the flickering of the electric light.

It often happens that in pursuing one line of research a man of science is led into another; and Prof. Bell, in seeking to improve his photophone, arrived at what appears to be a new discovery of moment. It has long been known that when a bar of iron is rapidly magnetized and demagnetized, it gives out a musical note of a pitch corresponding to the number of magnetic impulses per minute; and Prof. Bell found that all kinds of diverse bodies were rendered tuneful by the impact of an intermittent beam of light. Thin disks of wood, glass, metal, ivory, india-rubber and so on, yielded a very distinct note. The apparatus he devised for these experiments is a mirror reflecting a powerful beam of light from the sun or an electric lamp, through a lens, and in the path of the beam is mounted a rotating wheel, perforated round the rim with a circle of holes. This wheel acts as a screen to the light, except when one of the holes comes opposite the track of the beam. The latter then passes on to a pair of lenses, which direct the parallel beam toward the surface of a thin disk of the material under examination. When the wheel is rotated, the intermitted beam of light falling upon the disk behind causes it to ring with a musical tone whose pitch depends on the number of flashes per minute, and the ear-tube attached enables the listener to hear it without interference. This musical photophone is in reality a light-syren, like the air-syren of Cagniard de la Tour, in which the puffs of air escaping through the holes of a revolving disk emit a note. The disk form, though advantageous, is not essential to the effect. Crystals of sulphate of copper, chips of pine, even tobacco smoke held in a glass test-tube before the beam, are found to yield a beautiful tone. Nor is it necessary that there should be light, for if the light-rays be cut off by a thin sheet of hard rubber or vulcanite, the invisible heat-rays which pass through the opaque screen are capable of producing the effect. Indeed, it is still a moot point among investigators whether the effect may not be due entirely to the vibratory expansion and contraction of bulk due to the recurring blows of the heat-rays. So distinct is the effect that the naked ear held to the disc appreciates it, and even the outer ear itself acts as a receiver, for when the intermittent beam is simply focused in the aural cavity a faint musical note is heard.

Beside their practical promise, these interesting achievements of Prof. Bell have a poetic bearing. We are at once reminded of that mystical stone of Memnon which the sunshine made harmonious, and can imagine how the chequered sunshine of trembling leaves is musical to finer ears than ours. In Dean Milman's "Martyr of Antioch" the god Phœbus-Apollo is invoked by the chorus of maidens as—

> "Lord of the speaking lyre
> That with a touch of fire
> Strik'st music which delays the charmed spheres."

And truly the deep connection between light and music is curiously exemplified in the photophone. Prof. Bell, indeed, has played the part of a god, for has he not

inspired a ray of light? Great as his invention is, however, it is probably but the stepping-stone to one still greater which is to come, namely, the transmission of light itself by means of electricity.—*London Journal of Science.*

INFLUENCE OF ALTITUDE ON CHARACTER.

R. T. VAN HORN, IN KANSAS CITY JOURNAL.

There is a theory held by many that altitude has a controlling influence on the character and proclivities of the human race, and that the highest development is to be found at the higher altitudes. However this may be, it is a fact that all the saviors of the world, the great prophets and teachers, were natives of high lands, and what is, perhaps, better still, of good climate and pure atmosphere.

For example, astronomy was born on the Chaldean plains, where there was a clear sky for most of the year, and where men slept on the roofs of houses, with the stars in sight whenever their eyes opened. Could such a science have originated amid the fogs of the Thames, or the swamps of the lacustrine regions, where noxious insects and reptiles invoked the vigilance of waking hours?

Whether these are pertinent inquiries or not, they are suggested by some curious facts disclosed by the census tables. One set of tables prepared by Dr. Gannett, gives the population of the United States by drainage basins, and the following table gives the number that live habitually at different elevations above sea level, from the shore to 100 feet and so on. It will be examined with great interest:

Height above, feet		Population. 1870	Population. 1880
0—	100	7,233,550	9,152,003
100—	500	8,653,603	10,775,250
500—	1,000	15,127,227	19,025,617
1,000—	1,500	5,620,101	7,903,811
1,500—	2,000	1,191,293	1,876,885
2,000—	3,000	360,059	664,851
3,000—	4,000	79,349	128,348
4,000—	5,000	84,319	166,545
5,000—	6,000	135,483	271,321
6,000—	7,000	58,466	94,980
7,000—	8,000	6,304	15,053
8,000—	9,000	7,390	24,947
9,000—	10,000	705	26,846
Above	10,000	522	26,400

Here we have some remarkable facts: One-fifth of the American people live less than 100 feet above the level of the sea. Another fifth at less than 500 feet, and nearly one-third below 1,000 feet, while 97 per cent. of the whole population live below 2,000 feet. Necessarily, the people living at these different altitudes follow avocations based on the products of those elevations, modified by latitude. We, here at the confluence of the Missouri and Kansas river, are about the great-

est average, 1,000 feet, and all over the continent, as a rule, these people are agricultural. Below that, and at 500 feet and less, comes what we call the planting population in Southern latitudes, and the great seafaring, mercantile and very largely, the manufacturing. At and about 2,000 feet we find the pastoral plains and the equivalent of the Arabic population of Asia, and above that the miners and delvers after the mineral wealth of the globe.

Looking at this table, then, and taking what we know of the products of the soil at these different altitudes in different latitudes, we are just what the law of our habitat makes us, an intensely agricultural and commercial people combined, and until the great interior plains and table lands are populated, we cannot be anything else. When we get 10,000,000 people above 3,000 feet, then we will develop a civilization based more upon the imagination than we can have now, and æsthetic and scientific influences will have a larger and molding effect upon the national character.

The movement of the human race within the historic period has been from the interior of the continents to the seashore. When the caravan was the means of commercial carriage, the great capitals of the world, Babylon, Nineveh, Palmyra, etc., were in the interior of the continents, but when the seas began to be traversed by improved methods of navigation, the great commercial marts were transferred to the shores of the sea, at harbors and at the mouths of great rivers, and so it has gone on until the facts disclosed by such tables as the above have become the chief features of modern civilization.

But we may date the reversal of this tendency from the discovery of steam. While it has intensified the developments to the seashore in one sense, owing to the speedy navigation of the oceans, yet it has also enabled water craft to ascend the rivers and found great cities once more in the interiors of the continents. But the radical influence in this direction has been the railway. The iron horse and his train have taken the place of the ancient caravan, and the movement of the race to the interior has begun with decided force and volume. For example, ten years ago the railroad had barely got beyond an elevation of 4,000 feet, and there were then living at that altitude and above, but 363,583 people, while to-day there are 754,449. This population has more than doubled in ten years.

This drift of the population will grow in intensity as the facilities increase and as men learn to adapt themselves to the life and industries that belong to this elevated region; when irrigation becomes fixed, organized and understood, and the riches of the mines are supplemented by the wealth of the soil, there will be developed a civilization akin in direction to that of the ancient times, and with it characteristics and qualities—physical, intellectual and moral—such as it is now impossible to realize. We will then be a completely developed nation, balanced in all respects, and less one-sided and imperfect than we are now, and more so than any nation can be without the physical geography that belongs to us. In fact, the configuration of other continents and their latitudes are not adapted to a great, diversified yet homogeneous people, and it is this fact of topography which has been one source of diversity in character, language

and social economy, and that has made of mankind hostile states and warring peoples. In the order of development this continent seems to have been reserved for a polyglot race, without entangling traditions and with a configuration that makes them one people and one great interest. Our mountain ranges throw the rivers to a common outlet, and the valleys cannot be populated by a divided people. To these the progress of science and discovery have furnished the methods of intercommunication so rapid and intimate that the health giving elevated lands of the interior can be utilized as readily as the marine coasts, and thus the race takes its return movement to the sources of its origin and in search of a development more grand than it has ever known. This is the lesson taught by these figures of the census.

GEOLOGICAL ACTION *vs.* ENGINEERING.—THE RIVER AND THE GULF.

An engineer in the service of the United States, in describing an engineering performance at the mouth of Pascagoula river, drops a few remarks in the way of casual commentary which may escape general notice, but which are nevertheless of considerable importance to the public. It was no mean engineering feat which he was describing. A light-house at Pascagoula inlet, built upon screw-piles, was threatened with destruction by the action of the sea. The screw-piles had not penetrated below what might be called the surface sand of the coast, and the shifting of these sands threatened to undermine the supports of the light-house. A new foundation was built three hundred feet distant, by driving wooden piles seventy feet long, and the building was moved on a trestle built from the old to the new supports. During the period of transfer the light was kept burning as usual, and the whole operation was marked by a rare exercise of engineering skill. But in summing up, the engineer remarks that the outlying islands along the gulf coast were evidently formerly farther out at sea, and are gradually undergoing a process of erosion and re-deposit which is removing them farther inland. In boring on the new site of his light-house he found below the surface-sands the remains of a shore marsh, with the plants in a good state of preservation, and he infers from this and other considerations that the shore of the gulf is subsiding, and that the Mississippi river is backing up. Perhaps he has other observations behind this conclusion, but his apparently incidental inference is one which it is at least worth while for the government to notice.

If the gulf coast is really undergoing a slow subsidence, the fact ought to be verified. It is undoubtedly true that the lower Mississippi is less able to discharge the water that comes down from above than formerly. The levees, which were once adequate to protect the bottoms from overflow, have now become so liable to fracture when the river is but moderately full, that little reliance is placed on them. This has been attributed to the gradual elevation of the bed of the river, and the scouring of the river bed to a greater depth is the object of the plan of

improvement adopted by the River Commission. It is held by Captain Eads and others that the elevation of the bed of the river is due to the scattering of the water in times of flood, and that the remedy consists in confining it to its legitimate channel. The spreading of the water over a wide expanse deadens the current and produces deposits of the sediment which the water bears, and the more the water is spread out the greater this deposit becomes. As the bed of the river is elevated the facility of overflow is increased, and the deposit of silt in the bed of the river is gradually increasing and the river is filling up with a constantly increasing rapidity. But if the engineer of the Pascagoula inlet is correct, the mouth of the river is gradually rising, and all the effects ascribed to a gradual elevation of the river bed may proceed from this cause. What has been supposed to be an elevation of the river bed, may be, after all, a subsidence of the river banks.

That the river has been gaining on the low lands along its banks during the period which has elapsed since those lands were occupied for agricultural purposes, is certain. Lands which were once practically exempt from inundation through the protection of slight levees are now virtually unavailable for cultivation through their almost certain liability to overflow. The theory of Captain Eads is that the river is rising above them, but the Pascagoula engineer suspects that they are sinking beneath the river. There are no old observations that we are aware of by which the level of the water in the gulf may be tested. The engineer in charge at Pascagoula inlet refers to no statistics to substantiate his opinion that the coast is subsiding, but appears to base it solely on the evidences furnished by his explorations that such a physical change is going on. That there has been a relative change between the level of the bed of the lower river and the land along its banks within the last half century is certain. What has caused this change is not so certain. Either of the two causes assigned is sufficient, and a few years of observation would decide as to the value of either. Of course the operation of either cause is very gradual. The river, if it is filling up at all, is filling up very slowly; and the land, if it is sinking, is going down very gradually. It is only by accurate observations through a series of years that the true factor of change can be detected. Whatever it may be, it can not affect the plan adopted for the improvement of the river; but if the lands which have not very far back in time risen above the waves of the Gulf are again sinking beneath them, their owners ought to know it. They are now struggling against present disaster with the hope of future prosperity, and if that hope is baseless the sooner they know it the better. They are wasting time in trying to live down the assaults of the river if their real enemy is the gulf, and the Government would do well to instruct its engineers to either verify or prove their inference.—*Globe-Democrat.*

Sir Wyville Thompson has estimated that the pressure on a man's body at a depth of 12,000 feet beneath the surface of the sea would be equal to a weight of twenty locomotives, each with a good train loaded with pig-iron.

HISTORICAL NOTES.

INCIDENTS OF EARLY TRAVELS IN MISSOURI.

JOHN P. JONES, KEYTESVILLE, MO.

The first traveler in the Mississippi Valley, who in the account of his travels, has left a claim of having ascended the Missouri river, is Baron La Hontan.* It would be more satisfactory to investigators of our early history, if full faith could be given to the Baron's recitals, but some of his statements in reference to his travels north of us, are known to be false, and it is therefore difficult to determine from the meager facts that he relates, whether or not he ever was on the Missouri. He claims to have entered the river at its mouth, on the 17th day of March, 1689, and to have reached the first village of the Missouri, on the 18th, and the second village on the next day. Three leagues from this village, he says, they reached the mouth of the Osage and encamped. After a skirmish with a body of Indians, they re-embarked and started down stream; landing his force during the night, they destroyed an Indian village and, re-embarking, reached the mouth of the river on the morning of the 25th. The next day he met some Arkansas Indians, and says, "All that I learned from them was, that the Missouris and Osages were numerous and mischievous, that their country was watered with very great rivers and, in a word, was too good for them." It is possible that what the Baron learned from these Indians was all the information he obtained concerning the Missouris and Osages and their countries.

Father James Gravier,† under date of Feb. 15th, 1694, writes of a visit made by some Illinois Indians and two Frenchmen, to the Missouris and Osages, as follows: "About the middle of May, the deputies of the Indians of this village, accompanied by two Frenchmen, set out to seek the alliance of the Missouris and Osages. These French traders, with a view of opening up a profitable trade with these tribes, have made them some proposals for peace, to which they have consented only out of considerations for the French, in consequence of which they have become reconciled with the Osages."

"I would cheerfully have made this voyage in order to see with my own eyes, whether there was anything to be done for God's glory among the Tamaroa and

* "New Voyages to North America, 1683 to 1694." Written in French by Baron La Hontan. Done into English and published at London 1703.

†One of the many zealous priests of the Society of Jesus, who lost their lives in the valley of the Mississippi. He first visited the Illinois in 1687, but returned to the Ottawa Mission the following year. In 1693 he was again among the Illinois and spent the most of his time with them until the year 1705. During that year he was dangerously wounded in a mob raised by the medicine men of the Peorias, and descending the Mississippi to Mobile, died early in the following year from the effects of his wound.

among the Kaoukia,* who are Illinois, and to sound the Missouris and the Osages, in order to see what could be expected of them for Christianity, not doubting but that I would have found many children and dying adults to baptize, but as there are libertines there who, to continue their disorderly life, do not relish the presence of the missionary, I contented myself with telling them that I would cheerfully have made the voyage with them, that its difficulties and hardships would have been agreeable to me while laboring for the interest of God. About the 25th of June, the French and Indians, who had started from here last month, to go and solicit the alliance of the Osages and the Missouris, in the hope of the great profit they were to derive from their trade, returned with two chiefs, one of each village, accompanied by several sachems and some women. Although these traders care little about teaching them to know God and the missionary in any important thing they undertake with the Indians, they have nevertheless all come to see me, and I have given them the best welcome I could. I took them to the chapel and spoke to them as though they understood me perfectly. They attended mass and were very well behaved there, like the Illinois whom they heard me instruct several times and cause to pray. They evinced to me great joy arising from the hope that I have given of my visiting them to give them sense. This is their way of speaking, but being alone I cannot assist or visit the other towns of the Illinois who are on the Mississippi river.

"The Osages and Missouris do not seem to me as bright (spiritual) as the Illinois. Their language seems to me very difficult. The former do not open their teeth and the latter speak even more from the throat than the former."

From this letter, it would seem that the Illinois traders were endeavoring to carry out La Salle's scheme of gathering the neighboring tribes around the Illinois village for the purpose of trade; but this, like other plans of the great explorer, was, to a certain extent, visionary, and only capable of a partial realization.

It is also evident from the letter, that the reverend father was now for the first time brought in contact with Indians who spoke dialects of the Dacotah language, as he remarks the guttural sounds of the Missouris and Osages, as compared with the language of the Illinois, who were of the Algonquin family.

La Harpe's Journal has the following account of a voyage to the Missouris and Osages: "Dec. 29th, 1719, M. de Bienville† received a letter from M. Dutisne,‡ of the Kaskaskias, dated Nov. 22d, 1719, containing a narrative of his voyage to the village of the Missouris by the river, and by land to the Osages and Paniouasas,§ both in 1719. He said in his letter that he had been obliged to

*Tamaroas and Cahokias—Illinois tribes who were located at that time between the Kaskaskias and the Mississippi river.

†Bienville was at Mobile at this time, from which place the affairs of the entire colony were directed.

‡Claude Charles Dutisne, a person whose entire history is a romance. He was born in Paris, and at the age of sixteen, entered the service of a company engaged in mercantile pursuits in Canada. Was commissioned an ensign at the age of seventeen for meritorious conduct in dealing with the Indians, and served with distinction as an officer in the Colony of Louisiana until his death. He was made a captain in 1721—was in command at Natches in 1722. His son was captured in Bienville's ill-managed expeditiòn against the Chickasaws in 1736, and was burned at the stake with Vincennes, D'Artaguette, Father Senae and others. A daughter married DeGrondel, then a lieutenant, afterwards a brigadier-general in the French army.

§Pawnee.

change his plan in his first trip to the Missouris, because they were not willing to permit him to go to the Paniouasas. He had observed that from the Kaskaskias to the Missouri it was thirty-two leagues; that the waters of that river were very muddy and that it was full of obstructions of wood and rapids with strong currents; that it runs to the village of the Missouris to the north northwest, after several bends; that it is wooded by various species of trees; that one may see from it beautiful fields, vales and bluffs, at intervals; that on the west side of the Missouri, there are two rivers, the Blue—quite large, and that of the Osages, whose villages are eighty leagues above its mouth on the southwest side and which is navigable twenty leagues above this nation; that the beginning of the river is ten leagues from the Blue and forty from the mouth of the Missouri; that in the neighborhood of the Osages are very abundant mines of lead and other metallic ores, which have not yet been examined; that it is eighty leagues to the village of the Missouris by the river of that name. One league from this village, in the southwest, is a village of the Osages,* separated from the other large village of this nation, by thirty leagues. In the narration of his voyage by land to the Osages and Paniouasas, it said he had explored the Mississippi to the Saline, about two leagues from the Kaskaskias and thirty from the Missouri. According to his reckoning, it was more than an hundred and twenty leagues from the Salines to the Osages, whose village is situated on an elevation a league and a half from the river which bears their names, on the northwest side, and is composed of one hundred wigwams and two hundred warriors. This nation does not remain in its village, but like the Missouris, pass the winter in hunting the buffalo, which is common there; and there are seen the horses which they steal from the Panis. These savages are well formed, cunning and treacherous and great runners. They have several chiefs in their band who are almost absolute. There is an abundant mine of lead twelve leagues from their habitation, but they are ignorant of its use. From the Osages to the Paniouasas, forty leagues to the northwest, it is all prairie and hills covered with wild buffaloes. There are four rivers between the Osages and the Paniovasas one must cross; the largest, which is a branch of the Arkansas, is filled with rapids. This branch of the Arkansas is twelve leagues to the east of the village of the Paniouasas, which is situated by the banks of a stream, upon a hill shut in by prairie, to the southwest of which is a forest of great use to them.

"The village has one hundred and thirty cabins, of two hundred and fifty warriors. One league to the northwest on the bank of the same stream, is another of the same nation equally strong. They have together 300 horses, which they value highly and with which they will not part. This nation is not civilized, but it is easy to make them friendly by gifts. M. Dutisne adds that there were several other Panis villages to the west northwest, but they are little known. From the account of the Indians, it is fifteen days travel to the great village of the Padoucas,†; they fight each other to the death. Two days travel from the Pani-

*This village was located near the present town of Miami, Saline county, Mo. A description of an ancient earth-work near the site of this village appeared in the REVIEW for April, 1878.

†Now called Comanches. They were known among the valley tribes as Padoucahs. Their present name came from the Spanish.

ouasas to the west a quarter southwest, they have a pit of rock salt. M. Dutisne planted here the royal arms, Sep. 27th, 1719, but he ran the risk of his life, for this nation came near killing him at the instigation of Osages, who told them he only went there to make war upon them and carry them off as slaves. He proposed to them to go to the Padoucas, but they objected because they were enemies. They told him that the Mentas† were several days journey from the Osages on the southwest side."

The meager facts concerning the Osages and Pawnees given by the writer, are very acceptable, as they are the first recorded by any traveler from personal observations among them. We can but regret their paucity, as it would be interesting to know something of the manners and customs of these nations from visitors at their villages, before they had become contaminated by associating with the whites. At this time, the Osages had several villages on the Osage river, but Dutisne only gives the number of wigwams and warriors in one of them; in point of fact they were one of the most numerous tribes in the Mississippi Valley, and remained so for a hundred years.

From the text, it is hardly possible to locate the "pit of rock salt" or saline where Dutisne raised the French standard, but I am inclined to believe that it was within the present limits of the Indian Territory. From the Osages to the Pawnees, it was one hundred and twenty miles to the northwest, but only thirty-six miles across White river; this would locate the Pawnees in southeastern Kansas. Two day's travel in a southwesterly direction from the Pawnees, the pit of rock salt was located, and this distance, I think, would bring it south of the Kansas line.

De Lisle, in his map published in 1720, locates four villages of Pawnees on White river. Du Pratz, in the map accompanying his work, locates them on the same river, but nearer its source.

FORT ORLEANS. WHERE WAS IT?

G. C. BROADHEAD.

The Spaniards recognized the importance of the Missouri river, and that the establishment of a post on that river, would tend to confine the French east of the Mississippi; with this end in view they projected a plan to conquer the Missouri Indians, who then lived on the banks of the Missouri a short distance above the mouth of the Kansas river, and also to plant a colony there. The Missouri Indians were on friendly terms with the French.

We are informed that a large caravan to form a colony started from Santa Fe in 1720, and marched in pursuit of the Pawnee village, who at that time were at war with the Missouris. Being somewhat bewildered on the route, they reached, as they supposed, a Pawnee village, but which was a Missouri village. They

*One of the Arkansas tribes, and is located on early maps near the mouth of White river.

were free in expressing their designs, and therefore feeling no alarm, thinking themselves among friends, were surprised in the night by the Indians and the entire party killed excepting the priest. * This happened somewhere within the present bounds of Kansas.

This bold measure of the Spaniards awakened the French to their danger. M. De Bourgmont with a considerable force took possession of an island in the Missouri river some distance above the mouth of the Osage on which he built Ft. Orleans. M. De Bourgmont in 1724 with a few French soldiers and a large body of Indians marched northwest for some distance and met many tribes of Indians with whom he formed treaties and established peace. He set out July 3d and returned November 5th. The next year, probably, Ft. Orleans was attacked and entirely destroyed by the Indians, all the French being massacred.

Lewis & Clark locate Ft. Orleans five miles below the mouth of Grand river and say that the fort was on an island, but the island at that time (1804) was washed away. They also inform us that the Missouri Indians formerly had a village on the north side of the river opposite this island. They further state, "that the Sauks and other tribes from the Mississippi destroyed this village and killed two hundred Missouris in one battle. The small remnant took refuge with the Little Osages, others joined the Otoes.

We would ask was Ft. Orleans there situated and from whom did Lewis & Clark obtain their information?

SNIABAR.

Many strange associations have clustered around this name. And many, not knowing, believed the "Sny" hills were covered with the densest brush thickets in which dwelt men wild and fierce.

The stream known generally as Sniabar originates from many small tributaries in the southeast part of Jackson and southwest part of Lafayette extending across in an east and west direction about ten miles. The Great and Little Sniabar empty into the Missouri river just east of Wellington.

Lewis & Clark in their expedition to the Rocky Mountains in 1804 speak of passing the mouth of *Eau Beau* or Clear Water creek, where two streams enter the Missouri near each other and about fifteen miles east of Fire Prairie creek.

In Gazetteer of Missouri, by Lewis Beck, 1823, mention is made of Snybar creek, a small stream running through Lillard (former name of Jackson and Lafayette) county and gives proper spelling as *Chenal Ebert* which, translated from the French, means "Ebert's Channel," or slough.

Mitchell's (1835) map of Missouri has this stream marked C. *aux Heberts*, about the same as Beck.

Wetmore in his Gazetteer of Missouri, 1837, has it *Schuyte Aber*, and defines

* Wetmore *Gazette* of Missouri; also Annals of the West.

it thus: *Chuyte*, a German word, meaning "cut off," and relates how an old trapper named Aber came to the mouth of the stream and mistook it for a "cut off" or slough of the river and steered his boat up some distance before discovering his mistake.

Long, in his expedition to the Rocky Mountains, 1823, speaks of the Little and Great *Cheny au Barre*, and says that a hunter named *Au Barre* was formerly lost there for some time, passing up one stream and then another, mistaking them for the Missouri. From these names, whichever may have been correct, the transition is easy to Sniabar, or Snybar, still shortening to Sny.

G. C. BROADHEAD.

The monthly notices of the Royal Astronomical Society for March mention the great number of sun spots recently visible. These spots make unusual activity in the sun, and the theory is that there has been a general meteorological disturbance. The increased solar energy is believed to have licked up more than the usual quantity of water, in the southern seas, to be precipitated in our hemisphere. There have also been great magnetic disturbances, which have been attributed by some to solar influences.

BOTANY.

DARWIN ON MOVEMENT IN PLANTS.

DAVID S. JORDAN.

The purpose of Mr. Darwin's latest work is to give a detailed account of a great number of experiments on the movements of different parts of growing plants, together with a general *resume* of what is known of these movements and their causes. The accounts of the experiments are, of necessity, extremely technical, and are intended for the use of botanical investigators rather than for the general reader. The discussions and conclusions which accompany them will, however, interest every one who has the slightest curiosity in regard to the actions of "our brother organisms, the plants." These parts of the work, "to save the reader trouble," have been printed in larger type than the more technical portions.

A few of the more interesting facts developed by Mr. Darwin's investigations may be here briefly summarized. First of these must be placed the central idea of the book—that of the "circumnutation," or perpetual squirming, of the growing parts of all plants. It is known to every one that the stems of the various

twining vines wind about other objects, bending successively to all points of the compass, so that the tip revolves. Thus if the tip of such a plant at a certain time bend toward the north, it will afterward "be found gradually to bend more and more easterly, until it faces the east; and so onward to the south, then to the west, and back again to the north. If the movement had been perfectly regular, the apex would have described a circle—or, rather, as the stem is always growing upward, a circular spiral." But the figure described is always irregularly oval or elliptical, because this motion is never perfectly uniform for all sides.

This phenomenon of the revolution of the apices of plants is called by Mr. Darwin "*circumnutation.*" It is shown in the present work that circumnutation is not peculiar to twining plants, but that in a greater or less degree all growing parts of every plant—the roots, branchlets and leaves—have the same motion. Moreover, the various movements of plants are nearly all simple modifications of circumnutation.

"The great sweeps made by the stems of twining plants and by the tendrils of other climbers, result from a mere increase in the amplitude of the ordinary movement of circumnutation. The position which young leaves and other organs ultimately assume is acquired by the circumnutating movement being increased in some one direction. The leaves of various plants are said to sleep at night, and it will be seen that their blades then assume a vertical position, through modified circumnutation, in order to protect their upper surfaces from being chilled through radiation. The movements of various organs to the light, or from it, are all modified forms of circumnutation—as, again, are the equally prevalent movements of stems, etc., toward the zenith and of roots toward the center of the earth. If we look, for instance, at a great Acacia-tree, we may feel assured that every one of the innumerable growing shoots is constantly describing small ellipses; as is each petiole, sub-petiole and leaflet. * * If we could look beneath the ground, and our eyes had the power of a microscope, we should see the tip of each rootlet endeavoring to sweep small ellipses or circles, as far as the pressure of the surrounding earth permitted. All this astonishing amount of movement has been going on year after year, since the time when, as a seedling, the tree first emerged from the ground."

The growth of young seedlings and the motions of the different parts of the young plants are the subjects of a majority of the experiments made. The very tip of the root is its most sensitive part, and it alone controls the direction taken by the descending axis. Wherever it goes, the growth of the root must follow; hence it is very important to the plant that from the first the root-tip should follow the best possible path. The natural direction of the root is downward, following the impulse of gravitation (*geotropism*); the tip, if the soil permits, pursuing a spiral or corkscrew-like direction downward. The root-tip, moreover, is sensitive to contact with different substances, and chooses the direction of least resistance; it is sensitive to moisture, turning generally in the direction of the greatest dampness; and to the action of light, usually turning away from it.

"Authors seem generally to look at the bending of a radicle toward the center of the earth as the direct result of gravitation, which is believed to modify the growth of the upper or lower surfaces in such a manner as to induce curvature in the proper direction. But we now know that it is the tip alone which is acted on, and this part transmits some influence to the adjoining parts, causing them to curve downward. Gravity does not appear to act in a more direct manner on a radicle than it does on any lowly organized animal, which moves away when it feels some weight or pressure.

"A radicle may be compared with a burrowing animal, such as the mole, which wishes to penetrate perpendicularly into the ground. By continually moving his head from side to side, or circumnutating, he will feel any stone or other obstacle, as well as any difference in the hardness of the soil, and he will turn from that side; if the earth is damper on one than on the other side, he will turn thitherward as a better hunting ground. Nevertheless, after each interruption, guided by a sense of gravity, he will be able to recover his downward course and to burrow to a greater depth."

In a remarkable degree, the action of the sensitive and almost sensible root-tip is analogous to that of the brain of some of the lowest animals. The circumnutation of leaves is an upward and downward motion, by which are described very narrow ellipses. The "sleep" of the leaves of certain plants—that is, the assumption of a direction at night different from that taken during the daytime—is shown by Mr. Darwin to be a modification of the motion of circumnutation. The leaves, both when awake and when asleep, are continually in motion, the motion being most rapid at the periods of transition between light and darkness. The sleeping leaves or leaflets place themselves with the axes more or less nearly vertical, some by turning upward, others by turning downward. The purpose of sleeping is conclusively shown to be the reduction of the amount of radiation of heat from the leaf—to prevent it from becoming chilled at night. The tender seed-leaves of very many plants, whose leaves do not "sleep," assume this vertical position at night. Mr. Darwin observes:

"It is impossible not to be struck with the resemblance between the foregoing movements of plants and the actions performed unconsciously by the lower animals. With plants an astonishingly small stimulus suffices; and even with allied plants one may be highly sensitive to the slightest continued pressure and another highly sensitive to a slight momentary touch. The habit of moving at certain periods is inherited by both plants and animals; and several other points of similitude have been specified. But the most striking resemblance is the localization of their sensitiveness, and the transmission of an influence from the excited part to another which consequently moves. Yet plants do not, of course, possess nerves or a central nervous system; and we may infer that with animals such structures serve only for the more complete transmission of impressions, and for the more complete intercommunication of the several parts."

This book is characterized by the same freedom from dogmatism and the

same patient attention to details which have marked all the works of the greatest naturalist of our time. A theory is worth little until it becomes a natural inference from known facts; and the best models of the investigations which furnish these facts have been given us by Mr. Darwin. Hence the superior vitality of "Darwinism" as compared with all other theories of the origin of species.—[*The Dial.*

ASTRONOMY.

ASTRONOMICAL NOTES FOR MAY, 1881.

BY W. W. ALEXANDER, KANSAS CITY.

The planets Jupiter and Saturn are in such close proximity to the sun that a favorable view of them cannot be obtained this month. As they are the most picturesque objects in this solar system, their absence causes a slight void in celestial scenery.

Venus, after the 10th, may be seen by morning observers rising a few minutes before the sun, and by the end of the month its position will be more favorable, rising at that time 1 h., 40 min. before the sun.

Mars is gradually approaching the earth and increasing in apparent "size and brilliancy," but it will be some months yet before it will be at its nearest point, and in the best position for observing; during the month it will be seen by morning observers rising on the first at 2 h., 5 min., a. m., and on the 31st at 1 h., 4 min., a. m.

Uranus will be favorably situated for observation this month, being in constellation Leo. It is visible to the naked eye when the moon is absent. Its position is east and south of Regulus, the brightest star in Leo.

The moon will partially eclipse the sun on the 27th, first contact occuring at 6 h., 42 min., p. m. The eclipse will continue from that time until sunset, the northern limb being covered by the moon in amount equal to about .1 of the entire disc of the sun.

Position of the constellation and stars on the 15th at 8 h., 30 min., p. m. Ursa Major is a few degrees north of the zenith, and Cassiopea is on the northern horizon. Castor and Pollux are visible in the northwest at a considerable altitude, and Procion in the west about an hour and a half above the horizon.

Virgo is now about an hour east of the meridian, and half way from the zenith to the horizon. It contains the bright star Spica.

Scorpius, the scorpion, is just rising in the southeast.

Coma Berenices is now exactly on the meridian, and about 10° south of the zenith. It is a group of very small stars, quite different from anything else in the heavens.

Bootes is the next constellation east of Coma Berenices. It is marked by the bright star Arcturus, which is of a reddish color.

Corona Borealis, the northern crown, is the next east of Bootes. It is composed of a pretty semi-circle of stars in the shape of a crown.

INTERESTING FACTS CONCERNING THE SUN.

Photography has proved an invaluable aid in the study of solar physics. By its help astromomers now obtain pictures of sun spots accurate in all their details, of the different phases of eclipses, and of phenomena of too short duration for the eye to fully appreciate. At the observatory of the Roman College, Rome, Italy, the late Father Secchi was accustomed to photograph the sun daily by means of an instrument invented by himself; and having carried on this operation for several years, he possessed a record of occurrences on the solar surface which has served as the basis of many important conclusions regarding our luminary. By comparing these pictures the periodicity of the spots has been determined; and from data thus obtained, astronomers have reached the belief that the sun acts not merely as a center of attraction and luminous source, but that it exercises a potent effect on magnetic phenomena.

The depth of the immense cavities forming the spots is usually about one-third the earth's diameter, and never exceeds 4 000 miles. The cavities are by no means empty, as the resistance which they offer to the passage of luminous currents show that they are filled with more or less transparent vapors. They are produced in the luminous exterior of the sun—the photosphere—and are craters therein, filled with dark vapors which cut off the light from the lower strata. They are the result of violent crises in the interior of the solar globe, which sometimes take place over large areas with great rapidity; at other times they occur quite slowly, last for a considerable period, and are seemingly intermittent in their violence. The material which composes the penumbra of the spots, and the cloudy bridges which cross or float over the dark portion, are masses of photospheric matter. These masses are the result of violent action taking place occasionally in the interior of the sun. Sometimes these actions are sudden; at others they take place slowly, and sometimes their action is renewed from time to time; and the interior trouble, of which they are but the manifestation, perseveres for a long period after their first appearances. In fact, in a great number of instances, there is a movement constantly going on, from the interior to the exterior of the sun, and this movement is shown to us by the upheaval and the projection of the luminous matter, the latter becoming visible under the form known to us as *facula.* But generally, if we study the luminous masses which are seen as spots, we find that they are comparable to vaporous clouds suspended in transparent medium. The currents and the particles of the photosphere are driven toward the center of the spots, where they dissolve and cease to be luminous. They are

often seen suspended at different heights in the solar atmosphere; and frequently the higher ones hide the lower from our view.

Solar spots are principally seen on two zones parallel to the sun's equator, one on each side of it, between 10° and 30° of latitude. The rotation of the sun was discovered by the displacement of these spots; but it is remarkable that this rotation is not similar on all points of the sun's surface. The angular speed is greater at the equator, and diminishes as the degrees of latitude augment in number. The sun does not revolve according to the laws which we suppose to govern the movements of a solid body, whence it follows that we should regard it as a mass of fluids. The sun's rotation is accomplished in a mean period of 25⅓ days; and we cannot as yet explain whether this rotation affects the solar atmosphere as well as the globe itself, for the interior regions are entirely hidden from us; but we can cite an indirect proof which has some importance, although it appears at first to be a little singular.

Herr Hornstein, discussing the magnetic phenomena observed at Prague, found in the movement of the magnetic needle a variation of which the period was 26.33 days. On comparing it with certain data, he attributed the phenomenon to the magnetic influence of the sun; and if we admit that the magnetic period above referred to is the same as that of the solar rotation, we find that the sun turns on its axis in 24.55 days. Magnetic phenomena thus give us a new idea of the period of solar rotation, which differs from that which we derived from study of the whole solar surface, but which is similar to that formed on a study of the sun's equatorial region.

Some recent studies of solar spectra in connection with sun spots and other features of the sun's envelope have led Mr. Charles S. Hastings, of the Johns Hopkins University, to form a somewhat novel theory of the sun's constitution and the conditions producing the more notable phenomena familiar to solar students.

Mr. Hastings finds, contrary to the received opinion, that the spectra of the center and the outer edge of the sun's disk are not precisely alike, though the differences are so minute as to escape all but the most perfect instruments and all methods which do not place them in close juxtaposition. Certain of the Fraunhofer lines, the thickest and darkest in the spectrum, notably those of hydrogen, magnesium and sodium, which appear with a haze on either side in the spectrum of the center of the solar disk, are sharp and distinct in the spectrum of the limb. Certain very fine lines are stronger at the limb, while other very fine lines are stronger at the center. The ordinarily accepted theory of the solar constitution and the origin of the Fraunhofer lines fails to explain these phenomena. The probable reasons for this failure Mr. Hastings discusses at considerable length in the January issue of the *American Journal of Science*, and then proceeds to frame a theory of the sun's constitution, which, he thinks, will satisfactorily explain all the observed phenomena. The limit of our space forbids more than the briefest summary of his conclusions.

His theory differs from that of Faye chiefly in localizing the phenomena of precipitation instead of regarding it as proper to all portions of the photosphere, and in supposing the precipitation confined to one or two elements. He attributes the granular appearance of the solar surface to ascending currents directed generally from the center of the sun. About these currents are necessarily currents in an opposite direction, which serve to maintain a general equilibrium in the distribution of mass. The ascending currents start from a level where the temperature is probably above the vaporizing temperature of every substance. As they move upward the vapors are cooled, mainly by expansion, until a certain element (probably of the carbon group) is precipitated. This precipitation, restricted from the nature of the action, forms the granules. The precipitated material rapidly cools, on account of its great radiating power, and forms a fog or smoke, which settles through the spaces between the granules till revolatilized below. It is this smoke which produces the general absorption at the sun's limb and the "rice grain" structure of the photosphere. The reasons for supposing the precipitated element to be of the carbon group—carbon or silicon—is simply that no other substances present the properties indicated by the cloud masses of the photosphere. It is pretty clear that the substance has a boiling point above that of iron, for iron vapor at a lower temperature exists in its immediate neighborhood. The element is not a rare one, and its molecular weight cannot be great, for though precipitated below the upper natural limit of its vapor, there are few elements found in abundance above it, and those in general of low vapor density. It is possible that the light coming from the sun is radiated from solid or liquid particles of carbon just at the point of vaporization; but Mr. Hastings is rather inclined to suspect that the photospheric material is silicon. There is also good reason to suppose, he thinks, that carbon is precipitated at a higher level, possibly along with the less common element boron.

The clouds of carbon or other smoke would naturally be drifted into spaces of downward flowing currents, thus forming sun spots, the characteristics of which are accounted for by the necessary behavior of smoke clouds sinking into regions of higher temperature. This explanation of sun spots and their allied phenomena is certainly plausible, and we shall look with interest for what older students of the sun shall have to say about it.—*Scientific News.*

A writer in the *Jewish World* points out that, contrary to the received idea, the elder Rabbins of the Talmud taught that the world was round. This is shown by a passage, in which, in discussing idolatry, the figures holding in the hand a baton, a bird, or a globe, were prohibited, because the baton symbolizes the dominion of the world, the bird that the world lies beneath it, and the globe is forbidden because it resembles the form of the world itself.

ZOOLOGY.

INSECT TRANSFORMATION.

MRS. JULIA P. BALLARD.

To those who have made insect lives a study, there is a certain fascination in watching the changes from egg to larva, from larva to pupa or chrysalis, and from chrysalis to imago, or perfect insect, which can be understood only by the lover of entomology.

The egg itself is a study. From the egg, with very few exceptions (such as some of the Aphides and Diptera), all insects originate. The eggs of insects vary in size, shape and color. Many of them are plain and smooth, and under the microscope show no greater beauty of finish than to the naked eye. Some are fluted, or grooved from a central ring, looking not unlike a fairy carriage wheel carved from pearl. Some are white, some yellow, and some a delicate green. Others, like those of the Danais Archippus butterfly, are conical and marked off in vertical lines, intersected with divisions giving them a basket-like appearance (Insect Lives, Fig. 5); and others still are biscuit-shaped and knobbed.

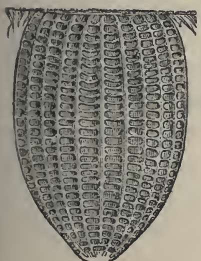


Fig. 5.

But more wonderful than the egg itself, is the fact that the different kinds of eggs are laid upon that plant, or in that locality, where the young, when hatched, will find its own particular food, or best be able to live. The Libellula, which flies on gauzy wing in the summer sunshine, always seeks the water to deposit its eggs, as the larva of the dragon fly *lives* in the water. It is a marvelous instinct which leads the Imago to remember that the element in which it sports will not support the life that first issues from its egg.

The first life, from the egg, is either in the form of larva, caterpillar or maggot. It may be more or less cylindrical, sometimes appearing to be without head or feet; or oftener having six feet. Those which have six feet are called larvæ; those without distinct head and feet, maggots, and those with six true feet and several membranous false legs, or "pro-legs," are caterpillars. The head of the caterpillar is the first of the thirteen segments into which the caterpillar is divided. The true legs are affixed to the next three segments. The pro-legs are short and muscular, larger than the true legs, and do not appear in the perfect insect.

The caterpillar, after changing its skin from three to five times, at length throws it off and assumes the pupa form. The larva varies as much in shape and color as does the egg—some being dull and without beauty, others, as that of the Danais (Fig. 7), handsome in shape, of a bright color, and ornamented with gold. Some

are suspended from the upper end of the chrysalis, like the Danais; some with a

Fig. 7.

silken cord about the breast, like the Asterias, and others change without being attached from any point. Some are smooth, others have protuberances, some are notched and ringed, and some knobbed. After a longer or shorter imprisonment, the chrysalis is broken and the Imago escapes. The butterfly or moth, at first limp and helpless, soon expands its wings, and fills one with wonder that so much could be compressed in so small a space. There is no other instance, probably, of such *wonderful packing* as the case of a butterfly.

When one reads of insect transformation merely, he knows but little about the many things which combine and render perfect transformation possible. Not every egg is destined to reach the Imago. Indeed, the wonder is that so many insects reach the perfect state. If the great number of eggs which the moth lays is taken into consideration, we can readily see that, did all come to perfection, such an invasion as that of the army-worm of the present season is not only possible, but that myriads upon myriads of insects would cover the land. If, then, the entomologist is annoyed when the chrysalis he has watched for months at length develops into an ichneumon or other fly, or lies a hardened case, never to open, or gives up at last, through some injury, an imperfect butterfly, let him remember the utter inundation there would be if all the eggs should reach perfection.

I have sometimes wished, in looking at the elegant green house of the Danais, that it could remain, and not so soon have to be ruined by the issuing of the Imago. A few weeks ago (June 1880) this wish was curiously gratified. I had brought in two of the caterpillars of the Danais, [Fig. 4,] which, after eating for a day or two, suspended themselves for their change. [Fig. 6.]

Fig. 4.

Fig. 6.

Two days after I found one of them hanging limp and dead. I held my own "inquest," aud decided he had committed suicide rather than bear the confinement of his prison. The other had made his green and gold house. In a few days more I saw below the chrysalis on the box-floor a little white maggot, which changed into a brown pupa, and two others below the suspended caterpiller. At once I noticed a small hole in the side of the chrysalis, and I knew the parasitic fly had done its work. It was a case of arrested transformation and, fortunately for me, arrested at precisely that stage which allowed the escape of the intruding

fly in time to save the chrysalis; which is now, after a lapse of nearly six weeks—and which will remain—perfect in form, and although grown darker, still showing a hint of its former gold. It is far more of a prize than the perfect butterfly would have been. The little brown chrysalids have opened to disclose a fly very similar to the house-fly but some smaller.

Fig. 11.

Fig. 14.

The Asterias caterpillar [Fig. 11, Insect Lives,] is often intercepted by the intruding ichneumon fly, [Fig. 14,] which steals from the yellowish-green pupa after having eaten what should have been the velvet-winged butterfly. And again I have watched the change of the spring caterpillar of the "Camberwell beauty,"

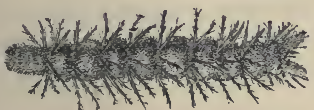


Fig. 17.

Fig. 20.

[Fig. 17,] to see its queer-shaped chrysalis opened by a bevy of several dozen tiny glittering winged ichneumons. A curious instance of imperfect transformation occurred this spring in the opening of a Polyphemus cocoon [fig. 20]. I had watched and fed the caterpillar (taken from the wood), along with two others which I had raised from the egg, (laid Sept., 1879,) and which two came out into large and perfect moths in March, 1880—and had seen it spin its cocoon. I was only repaid for the disappointment of its imperfect development by the curiosity it has afforded me for my collection. Eagerly I watched the opening of its cocoon; (being fortunate enough to see it at the first). When two feet and the head were free, it walked rapidly up the side of the box, carrying its cocoon with it. Having learned by experience, the danger and utter uselessness of aiding the exit of a moth, I watched this struggle with its adhering cocoon for hours, and at length, at intervals, for days; and all its life was lived in the cocoon,

peering out into a world of light and beauty, but clogged with a house of clay from which it was never freed.

Fig. 31.

Fig. 41.

The first Acrea [Fig. 31,] which I watched escape from its prison came near sharing the same fate; only escaping by an effort which sacrified a wing.

The caterpillar of the rosy Dryocampa [Fig. 41,] seems peculiarly liable to fail in making its chrysalis, perhaps one in four dying in the attempt. That of the Io Saturnia [Fig. 44,] is so armed with spines that it is more secure from the

Fig. 44.

attacks of the 'ichneumon; while the large tomato worm may think itself happy if it escape being transformed into a traveling show by carring a score of rice-

like steeples on its devoted back. Patience, and ability to bear disappointment are necessary to the student of insect transformation, and add to the delight which follows the cases of perfect development.

MEDICINE AND HYGIENE.

ORIGIN OF SOME OF OUR ILLNESSES.

Our illnesses arise from a variety of causes, and when we consider how many agencies of evil are at work to undermine health, the wonder is that we escape disease as well as we do. Sickness of any kind is simply chemical disarrangement of bodily organs or functions, or mental disturbances which concern the brain and nerves. We live in a peculiarly constructed house, a house complicated in every part, but exceedingly well adapted to our wants. As regards the materials of the structure, there is nothing about them very stable or peculiar. Apart from the bones, the human body is nothing more than a few pounds of earthy salts and animal tissues suspended in five or six buckets of water. The bones, the only solid portion, in no respect differ from our marble wash-basins and mantels, save in the amount of phosphoric acid they contain. So far as materials go, we have nothing in our tabernacle of flesh to boast of; but the unstable molecules are arranged in a marvelous manner, and, being subject to chemical laws and changes, like all organized matter, they often change places and assume new forms in an abnormal way. If we could contrive to keep chemical and mental action always under normal conditions, we should never be ill; we should die of old age, like the perfect combustion of a candle, which dies out for the want of more wax or paraffine. Whether it was originally designed that we should never be ill—that death, barring accidents, should result from the exhaustion of old age—is a question we may discuss and consider, and never reach any positive conclusions. We find ourselves existing in a world governed by law, and from the exactions of law there is no escape. There is one law which requires us to be temperate in eating and drinking, another requires us to hold in check our passions, another demanding that we protect ourselves from changes of temperature, and that we avoid external agencies which disturb the equilibrium of chemical forces; indeed, there are many laws, the violation of any one of which causes illnesses more or less severe.

Sudden "colds," so called, originate a formidable array of illnesses, many of which terminate fatally. What is a cold? This term is one well understood, and, in a popular way, means any illness resulting from changes in the temperature of the body or any of the organs. A cold is a disturbance in the circulation; the blood is turned away from its normal circuit, the functions of the skin are suspended, the heart's action is quickened, and the temperature of the body is

elevated. The troubles are of a serious nature, if not promptly attended to. That wonderful fluid, the blood, is an important factor for good or evil in the human organization, and it is very sensitive to changes of temperature and to disturbing agents. Everything that enters the stomach, or that passes into the system through respiration or by abrasions of the skin, is urged forward into the blood, and thus sent on its way, for weal or woe, to every part of the system. If the fangs of a rattlesnake pierce through the skin at the extreme end of one of the toes, the blood is there ready to receive the poison and hurry it on toward the heart, which, as soon as reached, falters in its action, and finally stops beating. The sting of a wasp or hornet discharges into the blood a virus of much less potency, which is taken up in the same way and carried toward the heart. Slight constitutional effects, however, are experienced, and the poison expends itself in local inflamation, which soon subsides. Quick poisons are for the most part simply powerful sedatives; the action is to suspend heart pulsations, and the patient dies from syncope.

If we are brought into an atmosphere in which floats the germ of small-pox, measles, scarlatina, diphtheria, etc., the germs pass into the air-cells of the lungs, and, penetrating the cell-walls, reach the blood. The heart receives them, but is not affected as by the virus of the rattlesnake; its direct action is not influenced, and the pulsations simply drive the septic matter into the general circulation. Here is the field for the exercise of its malign influence. One germinal particle, by a process of "budding" (a property peculiar to ferments), shortly becomes a thousand, then millions, of particles, and the normal condition of the blood is seriously disturbed. Great heat is engendered, the tissues are oxidized or burned with unusual rapidity, pustular eruptions form on the skin, which are but little surface volcanoes for the escape of the poison. The effort of nature to expel offending agents from the system is something wonderful. The struggle is entirely independent of the will, for the will is usually passive in severe diseases. If the system is capable of bearing up long enough under the disturbance, health is again established, but if not the body dies.

If we pour into the stomach substances foreign to its wants, substances which resist the normal functions of digestion, like alcoholic liquids and a hundred other vile compounds, the stomach expels them from its domain as speedily as possible; they are thrust out through the door which opens into the intestinal canal, and here the absorbents take them in hand, pass them over into the blood, and from thence they travel to all parts of the system. The stomach is the most abused organ inside of a human being, and fortunately has special powers conferred upon it of withstanding abuse. It has also the capability of taking terrible revenge for violence and injustice done to it. The man himself, or the woman herself, that is, the spirit, the intelligence, which temporarily resides in the physical structure, has no business to irritate and cripple the stomach, the most important apartment of all in the house in which he or she lives. We usually say, in speaking of the body, *my* body, or our *our* bodies; but do we *own* these

structures? Do we own them, as we do farms or merchandise? Do we obtain them by purchase? No. Here is a life principle, which, in order to become developed and fitted for a higher life, must have a material machine in which to exist and act. Nature provides a perfect machine, or one as nearly perfect as circumstances perhaps require, and this is *loaned* for the time being. It is only fair that we should take the best possible care of it; but if the motive of justice is ignored, then that of selfishness comes up with its claims. The purely selfish man finds it for his best interests to take good care of his body, and when it comes to special organs he guards well the stomach from abuse.

But a kind of delirium clouds the minds of millions; the weak, the irresolute, the viciously inclined, forget or ignore all self-obligations. They drench and drown their stomachs by pouring in gallons of vile ale, beer, rum, whiskey, adulterated wines, etc., but the dread nightmare of dispepsia and delirium tremens takes terrible vengeance for this abuse. The glutton stands on no higher plane, and he must suffer as does the hard drinker.

There are illnesses which can be avoided and those which cannot be. We cannot well escape the influence of contagion in all its forms. We live in a world which abounds in unseen perils, but it is the office of education to point out sources of danger, and inform us how best to escape them. If we place on the walls of our dwellings, papers loaded with poisonous arsenical pigments, we ought to expect illness of the most serious nature, if we are readers and moderately intelligent. If we allow the waste of our dwellings to accumulate under floors, or under the windows, we ought to expect zymotic diseases to destroy ourselves or children, as science informs us that from these unclean spots arise germs which are fatal in their influence. In this age there are many illnesses which ought no longer to trouble us, as science has pointed out their source, and how to avoid them.—*Boston Journal of Chemistry.*

SANITARY ADMINISTRATION IN PARIS.

A report has been presented to the Public Works Committe of Birmingham by Mr. Till, the Borough surveyor, describing his visits to the principal continental towns. He says that in Paris every possible opportunity was given to him for the inspection of the municipal works. The following are Mr. Till's notes on the water supply, gas, paving, and sewerage of Paris:

Water Supply.—Until 1860 all water was supplied by the water company (Compagnie Génerale des Eaux). In the year 1860 the city council bought up all the company's rights and assets for an annuity, during fifty years, of £46,400, payable quarterly. At the same time the said company was constituted the administrative agent of the municipality for all matters relating to the future water supply. The company receives in this capacity a commission fixed thus: On all annual receipts between £144,000 and £240,000, 25 per cent.; between £240,000 and £400,000, 20 per cent.; between £400,000 and £480,000, 10

per cent.; on all over £480,000, 5 per cent. A long and careful inquiry by a special commission has just been completed, and their report presented. The main recommendation in the report is that private consumers shall have meters, and pay according to the quantity of water used. The present system of special contracts according to rent of house is found to be unsatisfactory and exceedingly wasteful. The water supplied to the city is of two qualities; the best comes from the Seine above the city, from the Vanne, the Dhuys, and from the wells, the supply from the latter being about 30 per cent. of the total daily supply. The Seine and other river water is not filtered before being delivered. The temperature of the well water is 39° F. The second quality is from the Marne and the canals. This is used for washing and watering the streets, and for industrial purposes generally, but not for cooking or drinking. It is intended largely to increase the supply of this quality of water, mainly for sanitary purposes. The municipality pays nothing for water used for public service.

Gas.—This does not belong to the city. It is the property of a company known as the "Company for Lighting and Heating by Gas." The charge for public lamps varies with the burner used. Of these there are three sizes, consuming respectively 100, 140 and 200 liters the hour. The charge to the city is, taking these in the same order, and per hundred hours, 1s. 3d., 1s. 8d. and 2s. 6d. respectively. If supplied by meter the cost is 3s. 10½d. per 1000 cubic feet. The private consumers may agree for so much per hour per burner, or may use an approved meter. In this case the maximum price permitted by law is 7s. 9d. per 1,000 cubic feet, being double what the city pays. The same applies to gas for heating or for gas engines. The illuminating power is fixed thus: Under a pressure of three millimeters, gas burning at the rate of 115 liters per hour shall give a light equal to the light of a Carcel lamp burning per hour 42 grammes of pure colza oil (3 millimeters, 0.12 inch). Where private consumers use meters they pay rent to the company. The city does not pay rent for meters registering gas used in lighting streets, but it does pay rent for those used in municipal buildings of all kinds. The gas company may demand monthly payments in advance. The company is not allowed to demand any other guarantee from the public. Recently a new mode of showing house numbers at night has been adopted. An upright frame in the form of a triangular prism, eight inches long, is fixed against the wall over the door. On each of the two visible sides is a plate of dark-blue glass, having the number in white letters. Inside the prism is a small gas jet. The first cost of this apparatus is £4, including fixing, and the cost of the gas about 22s. per annum.

Streets.—Of the whole street area 73 per cent. is paved, 22 per cent. being macadamized, and 3 per cent. asphalted. It is intended to pave all streets where the traffic is heavy. The dimensions of paving stones have been the subject of careful inquiry and experiment, and the size finally adopted has a surface of 6¼ inches by 4 inches, and a depth of 6¼ inches. On steep gradients larger stones are used. Formerly the size was 9 inches each way. These stones were

found to get rounded at the edges and corners, and to present an uneven surface. The steam rolling of the macadamized streets is done by contract, the cost being but little less than horse rolling. The asphalt carriage ways are bedded on beton 4 inches thick, well pressed down (in very wet weather bitumen is used instead, as the beton does not set quickly), over the beton a layer of mortar, and then, at the end of five days a layer of asphalt 1½ inch thick. The annual cost of footpaths of all kinds within the city is £43,000. The cleansing and flushing of streets and removal of house refuse costs annually £160,000. Each ward has its own set of sweepers, &c. Since 1873 a special tax has been levied for sweeping footpaths; previously each household had to do that duty. There are in all 3,120 men and women employed in sweeping the streets and removing refuse. The street watering on paved streets is done from April 15 to September 30; on others from March 15 to October 15. About 22 per cent. of the area of the streets is watered by jointed pipes, and the rest by watering carts. The *first* mode is stated to cost only *about half as much*, area for area, as the *second* mode, but then the amount paid for horse hire is nearly double that in Birmingham. The watering carts belong to the municipality; the horses belong to contractors. The hydrants used for street watering are about 40 yards apart; the jointed pipes by which the water is distributed are one inch in diameter, in seven lengths of 8 feet each, on wheels, the joints being made with gutta-percha, the man with his finger on the nozzle regulating the quantity of water put on. We found in the Rue Castiglione, the carriageway whereof is 22½ yards wide, that it took the man, on an average, thirteen minutes to water only 33 yards in length of carriageway, and as each length is watered he uses a broom to sweep up the horse dung, &c. With one of our horses and carts a man can put on thirty-five loads, of 330 gallons each per day, and this quantity is sufficient to cover 82,000 square yards, or say 2,343 yards per cart load. I do not consider the hose system suitable for adoption here, except in the case of steep gradients like High street and Bull Ring, where a horse would work with difficulty. Since 1873 the house refuse has had to be placed each night in convenient boxes, in front of the houses, the contractor's carts calling for and removing the same early in the morning. The removal of this house refuse costs the city £80,000 per annum; formerly it was a source of income to the amount of £20,000 per annum. Two causes are alleged for the change: (1) deterioration in the value of the refuse, owing to the diminished use of *wood* as fuel, and increased use of coal and coke for houses and factories, and (2) increased distance of farms from the city, owing to the increase of suburban villas.

Trees in Streets and Squares.—Of these there are now about 90,000, besides 20,000 in the cemeteries. The roots of the trees planted in the streets and squares have a network of small drains for the supply of moisture. These are connected by a central drain, having a valve, and leading to the main sewer. The average cost of a tree, including transplanting, propping, draining, grid, &c., is £7, and about 90 per cent. of the transplanted trees succeeded. There are three

nurseries for trees, with an area of 6½ acres. The qualities sought in such trees are (*a*) rapid growth, (*b*) shade, (*c*) non-liability to attack by insects; and the trees selected on these grounds are chestnut, elm, the western plane, lime, and maple. One hundred and fifteen men are employed attending to the trees. The seats in streets and squares number three hundred.

Sewage.—We visited the great sewer in the Rue de la Pèpinière, being met there by the officers of the municipality, detailed by order of M. Bufflers. This sewer was lighted up by means of fifty-six moderator lamps. The man in attendance showed the apparatus for pushing along sand and mud deposited on the bottom of the sewer. The sewer first inspected was of the second class. The water pipes and gas pipes are attached to the crown or sides of the sewers, thus avoiding tearing up the roadway when pipes need repairing. A truck, with paddle board moved by the current, is used to force along the sand and mud. We next visited the main sewer, or collector of all sewage coming from the right bank of the Seine. The mean velocity in the collector was 165 feet per minute. The sewers received (1) large portions of street sweepings; (2) storm water; (3) water thrown out from houses; (4) contents of water closets; (5) urine from closets fitted with double cylinder. From five hundred to six hundred men are employed in the sewers, of whom thirty-two work in the great collector. The length of this main sewer is seven and a half miles, the length of main on the left bank of river, five miles, and the total length of sewers in the city is five hundred miles. The daily outfall of all sewers is 300,000 cubic meters, or 66,000,000 gallons.—*Van Nostrand's Eng. Magazine.*

MINERALOGY AND METALLURGY.

THE MINES OF MEXICO.

Some years ago I went from White Pine to Mexico. As I passed Eureka (or where it now stands), Stetefeldt told me to stay, since Eureka would be the big camp of the coast. His prediction has been amply verified. My first visit to Mexico lasted five years and three months. I served as superintendent of three of the large mines (mentioned by Ward and Humboldt); I visited some of the celebrated old mining districts; and so was enabled to form something of an opinion.

The first idea of the *gringos*, or Americans in Mexico, is annexation to the United States. They are constantly urging it, and often make much trouble for themselves thereby. Our people are energetic, and rush ahead; but in so doing, they respect the rights of no one. They damn the country, the religion, the "grub," the law and the climate—everything.

The Mexicans do not forget the lesson taught them in California in 1849 and 1850. They well remember how they were rooted out of California, Arizona,

New Mexico, Colorado, Utah, Nevada, etc., and the Texan war is still fresh in their memories. They now number 10,000,000 of people, and it will not be an easy thing to annex them. They are well armed and will fight. So I think that the chances of annexation (under a Republican or Northern administration) will be small. If a Southern administration were in power, there would be a war with Mexico without doubt.

As to climate, there are three kinds: the hot country, the temperate, and the cold. The first is from the sea-level to 1500 feet above the sea; the second, or *templada*, from 1500 to 4000 feet above the sea; and the last from 4000 to 8000 or more feet above the sea.

Calenturas, or chills and fevers, are very common among the foreigners. Still, there are some very healthy natives—but of the chocolate-colored race. Our North American new-comers will suffer much from malaria; but in time they, or their children, will be acclimated.

The food one soon learns to relish. I often wish for a *cazuela de frijoles* and some *tortillas*, etc.

In manners the Mexicans are a kind-hearted people, and very polite in all the relations of life. This politeness extends to all classes.

As to mining, they have worked their mines for three hundred years, or thereabouts; we have worked ours only twenty; and yet we are far ahead of them in present annual product. This does not show that we have better mines. They can show a Valenciana for our Comstock, a Sombrerete and Zacatecas, Real del Monte and San Luis Potosi, Batopilas, Candelaria, Botaños, and Guadalupe de los Reyes for our Eureka, Tuscarora, Austin, Leadville, Ontario, Homestake, Tombstone and Bodie.

Our people must have some new excitement to rush to every spring. This time it is apparently going to be Mexico. No doubt, in some respects, the railroads will effect a wonderful change in Mexican conditions. What the result will be no one can tell. But I can safely say that there are good mines more easily accessible in our own country, and that many of our American companies in Mexico will be badly "cinched."

There are many points to be learned from the Mexicans in mining. They work their ores very closely—much more so than we do ours. But their processes require several stops and a long time. In the mines they work with few tools and appliances, and yet are very effective miners, using especially very little timber. The grand difficulty in Mexico is in getting around the mountains. The trails are frightfully bad. Railroads will run through the country, but will not benefit all the mining districts.

In 1824, the English made a grand rush into Mexico. Of the scores of companies not one remains—they all went under. The same thing occurred in 1864, when a rush took place from California. The disasters of those two periods will pretty certainly in many instances be repeated. In short, the Mexican boom,

like all the other mining booms, will wreck a good many adventurers, and carry a few to fortune.

In my next, I may give some descriptions of English and American enterprises.—*Cor. Eng. and Mining Journal.*

THE SAN JUAN REGION, COLORADO.

BY THEO. B. COMSTOCK.

San Juan County has had less snow than last year; but avalanches have been perhaps more frequent, though but little destructive. If late snows do not come, the season will open quite early. Not a few who have wintered in the East have already returned. The Denver & Rio Grande Railroad has been vigorously pushed, and it will very soon be completed to Durango, from which point it will be quickly extended to Silverton. Meanwhile, comfortable coaches will daily cover the intervening distance. The Upper Animas Valley, as far as the Animas Forks, will be provided next season with as good facilities for travel as last year, or better. Freight transportation must become much cheaper and more easily procurable than ever before, while the increased facilities for ore-reduction will undoubtedly give better prices and enable lower grades to be profitably treated.

There has been much less than the usual amount of "wild-cat" organization of San Juan companies here in the East this season, though one or two have slipped in unnoticed with the large number of good incorporations. Boston capitalists, with characteristic forethought and judgment, sent out some competent investigators last season, and the result of their labor is now apparent in at least some of the new enterprises brought to public notice in that city. Still, I feel it necessary to warn investors that not every one of these schemes is worthy of full support. Good companies will not suffer from my hint that high capitalization and stock speculation have already injured the San Juan country more than the failure of any business enterprise. In fact, it may be truly said that there have been no failures in San Juan; for in every instance of disaster, the fault has been with manipulators in the East. The mines are still there, ready to justify all that was ever predicted by competent authority.

The production of this district last year was actually less, by the records, than in 1879; but the work performed, the development of the mines, and the ore taken out were much greater; for we were placed in circumstances such as can never again occur, which gave us no tempting market.

Silverton has received new impetus from the forming of companies to work the mines in Cement and Poughkeepsie and other gulches, and good reports have been received from reliable sources of the work done this winter upon the productive veins in the neighborhood.

Arrastra and Cunningham gulches are not behind, and all at Eureka are more than ever convinced of the great value of the local fissures. There is now a very strong probability of important additions to the working facilities at this point,

by means of which a large amount of low-grade ore will be marketed at an early date. The Niagara Consolidated Company is making preparations for vigorous prosecution of development work upon its large bodies of rich ore, and there is now an assurance that it will take its place among the large dividend-payers.

Above Eureka, the new smelter near Burns's Gulch will have an opportunity to prove its worth ere the completion of the railroad and the competition at Durango give it the severest test of its ability to hold its own against such odds. It certainly has the best wishes of all in the upper valley at least, and its managers deserve well of the neighborhood for their energy and determination.

The Tom Moore Mining Company is one of the kind that reserves all its noise to the last; but one of these days its stockholders will be shouting for it in a body, because of the present economy of management and the dividends which this policy and the worth of the mines will eventually produce.

Animas Forks is flourishing, and the rich mines in the vicinity of Mineral Point, notably the Red Cloud, are behaving nobly, fully justifying the hope that has been placed in them.

I am not an authority upon Rico and Ouray in detail; but the true story that reaches me through letters and statements of the most trustworthy character, as well as from Lake City and other more familiar localities, may be briefly indicated by an article in my own creed, namely, "I believe in Eureka, and in San Juan County;" but what I say of these, in general terms, applies equally to all parts of the great San Juan country, than which there is certainly no greater mineral territory in the world. The proofs will be forthcoming as the years roll by, and long after this generation shall have passed away.—*Mining and Engineering Journal.*

DIFFERENT VARIETIES OF STEEL.

The following correct definitions of the different varieties of steel by William Metcalf, of the Crescent Steel Works, Pittsburg, Pa., are published in a circular by the Dexter Spring Company of Hulton, Pa.:

"This definition still applies, but in addition the term cast steel applies to all of the products of the crucible, the Bessemer converter and the open hearth furnace, whether such products are too low in carbon to harden or not. The steels that are not cast steel are known in the market as blister steel, German steel, shear steel and double shear steel.

"Blister steel is made by heating bars of wrought iron, bedded in charcoal, in hermetically sealed chambers. The carbon of the charcoal penetrates the hot iron, converting it into a crystalline mass of crude steel; large blisters rise on the surfaces of the bars, giving the name blister steel to this product.

"Originally the word steel was applied only to iron which contained such quantities of carbon as would cause hardening when the red hot iron was cooled suddenly.

"German steel is blister steel rolled down into bars. It is used mainly for tires and common springs, and is being rapidly superseded by the cheaper grades of cast steel.

"Shear steel is made by taking a high heat on blister steel and hammering it thoroughly. Double shear steel is made by cutting up shear steel, piling it, heating it and then hammering again. The best shear steal must be made from the best wrought iron. The shear steels are very useful on account of their toughness, and the ease with which they can be welded to iron, and when of good quality and well worked, they will hold a very fine edge.

"Crucible steel is made by melting in a crucible either blister steel or blister and wrought iron, or wrought iron and charcoal, or wrought iron and scrap steel; or, in short, a great variety of mixtures, which depend upon the quality of steel to be produced.

"Crucible steel can be applied to any purpose for which steel is used. Generally, it is better than any other steel—that is to say, crucible steel made by melting blister steel, and tempered to suit by mixing iron of the same grade in the crucible, is always better than German or shear steel made from the same blister.

"Bessemer steel is made by blowing air through melted cast iron, thus burning silicon and carbon out of the cast iron. After the silicon and carbon are burned out, melted spiegeleisen, or ferro-manganese, is added to the charge. The carbon in the spiegel recarbonizes the steel to the desired point, and the manganese unites with and removes the oxygen which the air used leaves in the steel.

"Open-hearth steel is made by melting, in a very hot furnace, a charge of pig iron; to this melted iron, which is called the "bath," is added, either wrought iron or scrap steel or iron ore, and the whole is kept hot until all is melted. The wrought iron, or scrap, or ore, reduce the carbon and silicon in the bath to such proportions as are desired in the steel.

"Bessemer and open-hearth steel are much alike in quality. They are used mainly for rails, boiler plates, ship plates, bridge and other structural purposes, and machinery. The better qualities are also used largely for springs. The best spring steel, like the best tool steel, is simply that which is made from the best material. Quality of material, chemically speaking, being equal, the best spring steel is that which is made from crucible cast steel, as the crucible process is less crude than either of the others.—*Age of Steel.*

ARIZONA COAL.

Allusion has heretofore been made to the discovery of large and valuable deposits of coal in Arizona. The location of the fields is near Saddle Mountain, twenty miles northeast of the junction of the Gila and San Pedro rivers, on the upper waters of Deer Creek. Some weeks ago a man brought in specimens of

coal, some of which he had used in a blacksmith forge in sharpening tools. A party was fitted out, who prospected the country, and after a week's search a much larger body of coal was discovered than was first reported. Speaking of this, the *Scientific Press* says: "This latter showed croppings, float and shale, in the easterly end of a valley about twelve miles in length, and all the ground in the vicinity with coal on the surface had been occupied when the second party reached the valley. They, however, followed down the same, occasionally finding evidences of the presence of coal, till near the southwestern end of the valley they found hundreds of acres literally covered with coal croppings. Where the waters, rushing down a wide cañon, had cut a wash-out of twenty feet in depth, they found the black walls reaching from the bottom to the top, while the floor of the wash was not still through the deposit. An examination of the location discloses what would appear at a cursory glance to be thirty ledges, all dipping into the hill to the southeast at an angle of twenty degrees, but which are doubtless only one or two, the surface being marked somewhat with the *debris* from the tall hills on that side. This party, with a few others who joined them in the valley, located 1,240 acres. In a few days the valley was full of prospectors making locations, and now nearly the entire valley between the two original discoveries is taken up and occupied.

"Specimens from the southwestern discovery were brought to San Francisco a few days ago and have been tested. It is a fine quality of semi-bituminous coal, generates gas well and cokes beautifully. It is free from impurities and deleterious matter, and is pronounced by competent judges to be the best article or quality of coal for this country. This coal field is not more than twenty-five miles from the point where the extensive copper smelters are soon to be erected by Mr. W. A. Ballinger, and will supplement the smelting industry southeast of Globe, now bidding fair to be very large and extensive. A competent engineer estimates the cost of constructing a railroad up Deer Creek to the mines at $10,000 per mile. Unquestionably this is a most valuable discovery, and will satisfy a need long and seriously felt in Arizona."

METEOROLOGY.

KANSAS WEATHER SERVICE OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA.—MARCH 20, TO APRIL 20, 1881.

BY PROF. J. T. LOVEWELL.

The last eleven days of March, which are included in this report were warmer than the first part of March, the sky much of the time being clear, and air very dry with no rain. The first week in April was very cold for the season, the

minimum temperature on the 9th being 47°. From this time, the 7th, to the 20, there have several slight showers, the most abundant being that of the 20th. On the 16th the temperature rose to 82°. The prevailing winds have been northwest and north. The total rainfall, 0.435 inches, is even less than that recorded last month; but this record closes with a rain storm in progress, which may betoken the beginning of our spring rains. This is nearly a month earlier than they began last year, and the wheat which had begun to suffer will be greatly benefited thereby. The first dog-tooth violets (*erythronium albidum*) were seen here April 9th. Elms and maples began to blossom about the same time, and cottonwoods a few days later; redbuds did not begin to open till the 20th. There was a slight snow squall on the 12th, and the night following the temperature sank to 16°. The wind has continued mostly from the north and northwest, and the highest velocity recorded was 58 miles per hour on April 1st.

The following summary by decades represents the averages as determined from our tri-daily observations:

Highest barometer, 29.27 on the 26th of March.

Lowest barometer, 28.50 on the 7th of April.

Highest temperature, 83° F. on the 17th of April.

Lowest temperature, 7° F. on the 4th of April.

	Mar. 20th to 31st.	Apr. 1st to 10th.	Apr. 10th to 20th	Mean.
TEMPERATURE OF THE AIR.				
MIN. AND MAX. AVERAGES.				
Min.	29 0	20.6	38.5	39.4
Max.	57.3	48.0	68.8	58.0
Min. and Max	43.2	34.3	53.6	43.7
Range.	28 4	27.4	30.3	28.7
TRI-DAILY OBSERVATIONS.				
7 a. m.	33.2	30.0	44.8	36.0
2 p. m.	50.0	43.3	63.7	52.3
9 p. m.	38.0	36.5	50.5	41.7
Mean	39.5	36.6	52.7	42.9
RELATIVE HUMIDITY.				
7 a. m.	.82	.85	.78	.82
2 p. m.	.58	.70	.56	.61
9 p. m.	.75	.82	.78	.78
Mean	.72	.79	.71	.74
PRESSURE AS OBSERVED.				
7 a. m.	28.94	28.99	28 88	28.94
2 p. m	28.94	28.94	28.83	28.90
9 p. m.	28 95	29.05	28.88	28.96
Mean	28.94	28.99	28.86	28.93
MILES PER HOUR OF WIND.				
7 a m.	13.8	18.1	11.3	14.4
2 p. m	27.6	19.7	18.4	21.9
9 p. m	13 0	17.5	10.4	13.6
Total miles.	4635	4333	3178	12146
CLOUDING BY TENTHS.				
7 a. m.	2.3	7.0	5.5	5.3
2 p. m.	3.0	5.5	5.5	4.6
9 p. m.	2.5	4.7	5.2	4.1
RAIN.				
Inches	0.00	0.035	0.40	0.435

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, March 12.

Periodically the trichina disease is notified as existing in the country; the fact is, the malady is as old as the hills, only within the last forty years it has received a new name. Its effects have been less baneful in France than in Germany, Italy or Switzerland, because, in this country, pork is more thoroughly cooked and the parasites thereby destroyed. Where illness or death has followed the consumption of trichinous pork, the latter invariably turned out to have been imperfectly cooked. The Germans, in 1840, called the disease *Schinkengift*, or ham poison, and *Wurstgift*, or sausage poison. The poison was simply trichinæ, discovered in 1835 by Ouen, and more popularly made known by Virchow. It was in 1851 that the public became alarmed, in consequence of several persons having died in the neighborhood of Hamburg after eating ham. In 1863, M. Langenbeck, of Berlin, while performing an operation—the removal of a tumor—discovered the patient's flesh to be alive with the animalcules: on being questioned, the patient admitted that he had been served with poisoned pork by an inn keeper, who, to avoid prosecution, had fled to America, perfectly unconscious of having committed any crime. The real criminal was the trichina. The latter is a worm, and can be found in man, cats, crows, vultures, rats, mice and moles, as well as in the pig. It exists in a little bladder-like vessel called a cyst, in the muscles, and by that channel is absorbed by us, resembling little white corpuscules, or pimples; magnified to 300 times its size, it resembles a small worm coiled up on itself. In the cyst the worm remains inert, but once in the intestinal canal, it becomes animated. The female is viviparous, and lays more than 1,000 embryos at a time, and can continue doing so during seven or eight weeks; these embryos, by their very smallness—for they have no perforating organs—pass through the membrane of the intestine, enter everywhere—into the very blood itself. When the worm finds a muscle suitable it develops itself rapidly, taking, after nineteen days, the form of larva. Here its role—its existence, ends; it forms a cyst at the expense of the muscle. The worm dies and passes off with other matters by the intestines. The diseased muscle, if eaten by an animal, will in due time yield up its worm, liberated by the gastric juice of the stomach, and so recommence its role of propagation. The intensity of the symptoms of the disease varies with the temperament of the individual, and the number of trichinæ absorbed; three days suffice for the incubation of the latter, when the patient commences to lose appetite, to feel vaguely out of sorts, to experience nausea and an ardent thirst; the lassitude increases, the features become swollen, and, as the animalcules emigrate among the muscles, the pain

becomes more acute; if they lodge in the respiratory muscles, breathing will be affected. Feebleness and exhaustion duly set in, and after six or eight weeks of suffering, the patient succumbs. In every country the trichina disease has produced victims. American pork is largely blamed as the chief cause, so that Italy, etc., refuses to admit importations of that meat. Prussia has a battalion of 18,000 inspectors to examine the pork, and despite that sanitary army they cannot prevent diseased meat from passing the frontier into France. At the abattoir here, it takes an inspector with the microscope at least fifteen minutes to examine the diaphragm—the most general seat of the disease—of a pig. It would require, then, a large army to control the 23,000 tons of pork sold by 1,000 pork butchers in Paris alone, the control being rendered more difficult where the meat has been cut up or salted. As many as one trichinous American ham, in ten, has been imported into Europe, and Messrs. Belfield and Attwood have discovered 13,000 of the worms in a cubic inch of ham. It is a serious step to prohibit the importation of American pork into France, as it forms, by its cheapness, the basis of the poor's animal diet. The law, however, holds pork butchers responsible for the consequences of selling diseased meat. So it is proposed to instruct them in the use of the microscope, as in Germany, to detect trichinæ themselves. In the meantime, the public is urged to give at least a good twenty minutes boiling to every pound of pork in the pot.

It is very common to give to soap a name recalling the sap of the plant presumed to enter into its composition. Thus there are lettuce, marshmallow and iris soaps, perfectly innocent of all connection with these plants. Lettuce is presumed to impart a green color to soap, though every one is aware its juice is white. The colorings of soap are intended merely to recall—by an appeal to the eye—their perfumes. Thus, rose presumes roses; violet, violets; and yellow, orange. It is aniline, whose raw material is coal tar, which supplies at present industry with nearly all its coloring ingredients. Before being employed for the preparation of soaps, the aniline dyes are first dissolved in glycerine. The juice of lettuce, which is white, is extracted when the plant is coming into flower, and is used, not for imparting a green hue to soap, but for preparing thridace—from the Greek *thridax*, lettuce—and the active principle of that substance, lactucarium, much used in medicine. It is sesquioxide of chrome that imparts the various colors to soaps, to tissues, to porcelain, glass, paintings, etc. When the oxide is combined with a certain quantity of water—known as in the hydrate state—it produces the most permanent, beautiful and unalterable greens, which are not poisonous like those from arsenic; it exists in the soap as an impalpable powder. Marshmallow soap is a combination of tallow and palm oil, but has not a trace of marshmallow; the same as bitter almonds soap is perfumed with nitrobenzine—not extract of with almonds. The "economical" soaps generally contain from 25 to 30 per cent. of earthy or primaceous matters. A good soap ought not to contain much water, as an excess destroys the perfumes; it ought to be completely deprived of free alkali, so as not to affect the skin; the alkali in

the case of soft soap, is potash; and for hard, soda; soap should be exempt from too much unsaponified fat, in order not to leave the hands pitchy; the water, if calcareous, will cause the soap to curdle or waste, and such will continue till the soap has saturated all the lime in the water.

The discussion is still continued in scientific circles as to what constitutes the surest indications of death. The rigidity of the remains, say the majority, although that has set in before the extinction of life. The flexibility of the members is a proof of the absence of death; but such can exist along with death. Bichat maintained, that in the case of the asphyxiated, no stiffness of the body is found, and Hunter asserted that such was absent in the case of death from lightning; a fœtus does not become rigid after death, according to many. However, rigidity is a phenomenon very constant after every form of death, and observed alike with vertebrate and invertebrate animals. Though this stiffness be peculiar to the muscles, other tissues, as the brain, the liver, the kidneys, present a rigidity analogous, while less marked. The rigidity is presumed to be due to the coagulation of the albuminoid matters which enter into their constitution. What is the difference between congelation and rigidity? A muscle in the latter condition has still a certain degree of elasticity, but a frozen muscle is hard as metal, and, when struck, sounds; when pressed, emits the cracking noise peculiar to tin. When does rigidity set in? The moment is very variable; immediately after death in some cases, and later in others. Sardines and whitebait become rigid immediately after asphyxiation. There is a close connection between this stiffness and muscular irritability. All muscle separated from the nutritive action of liquid blood passes through three stages; increase of excitability, decrease of same, rigidity and putrefaction. The stiffness is presumed to commence by the trunk and neck, next the thoracic membranes, and afterward the abdomen. The muscles of the jaw, according to some authorities, are the first affected. Upward of twenty-seven per cent of corpses become rigid within four hours, and twenty per cent within six hours. The turning in of the thumb against the palm of the hand, to be covered by the fingers, is not always a sign of death. There is a rigidity, a kind of catalepsy, peculiar to battlefields; thus a soldier has been found dead and stiff, one hand holding the bridle of his horse, the other his carabine, one foot in the stirrup and the other on the ground; another soldier, whose head had been carried off by a shell, held firmly in his hand a goblet full of water that he was in the act of drinking. These phenomena can be reproduced by killing rabbits. A sardine expires instantaneously when removed from the water, but a conger will live for a long time; birds become stiff sooner than rabbits, and the latter more rapidly than dogs. The influence of heat is an important point. Cold is declared to hasten rigidity; but an animal may be rigid and yet warm, as is illustrated in shooting game. Further, the cooling of a dead body proceeds slowly, often taking twenty-four hours to equal that of the surrounding air, because chemical changes take place a long time after life. In the case of deceases from cholera, madness and lockjaw, the body actually becomes warmer by two

or three degrees pending a space of four hours. There is, then, no connection between cadaverous frigidity and rigidity. In cold weather a dog will remain eight days stiff after death, while in summer it will hardly become rigid. Instance can be adduced where, in typhus fever, cadaverous rigidity set in though the pulse beat for three minutes later. Hares, when run down, are found with their legs rigid, and life not departed. Butchers always allow stock that have been driven from a distance to repose a few days before being slaughtered, as, if instantly killed, rigidity would set in at once, but later—due to the chemical action taking place in the muscles—that stiffness would disappear, and putrefaction prematurely arrive. This is the reason why in La Plata, when troops of cattle are destined to be killed for the European market, they are ever allowed several days of repose before entering the abattoir. In the case of animals poisoned by strychnine, their arterial blood is ever found to be black; rich in carbonic acid and poor in oxygen. It is by provoking asphyxia that electricity destroys life; a frog, however, can be charged with electricity for hours and be in no way affected, simply because frogs cannot be suffocated. When a muscle works, it becomes acid; perhaps this acidity contributes to cadaverous stiffness, although Claude Bernard has found the muscles of crayfish alkaline after death. Paralyzed muscles become sooner rigid after death than the others, but neither age, sex, nor physique modifies rigidity. On the whole, we know nothing certain of the causes which determine rigidity. Winslow, 'tis true, doubted that any certain signs existed of death; however, the presence or absence of rigidity, even when all other evidence is wanting, will indicate when death is definite. No confusion must take place between tetanic and cadaverous rigidity; in the former, when the stethoscope is applied to the muscle, the ear recognises a certain rustling; in the latter, absolute silence. In the case of catalepsy, the muscle, when acted upon by electricity, will contract; in the dead muscle no excitability will ensue. For juridical purposes, if a body be completely rigid, death may be set down as having taken place within two hours, and not extending beyond forty-eight, or in winter sixty. A corpse may be supple—proof that rigidity has disappeared, and which may occur in periods of great heat or deaths caused by lightning. The death of a muscle, then, is characterized by rigidity, which, till then, retained its irritability or life; the disappearance of that rigidity is caused by the forming acids dissolving the coagulated or stiffening matter of the muscles, thereby producing ammonia—the characteristic of incipient putrefaction. Cadaverous stiffness, then, belongs to the chemical order of phenomena.

A new method of reproducing photographs in colors on china will, it is predicted, completely revolutionize that art. By the new process a dinner plate can be converted into a veritable work of art at a slight expense—not one twentieth of the cost by the plan of hand-painting.

SCIENTIFIC MISCELLANY.

SCIENCE IN REVELATION.

BY REV. JAMES FRENCH.

The quadrature of the circle, according to the Legendre modulus, is a mathematical problem which Archimedes worked at ineffectually; but which was supposed to have been solved first by Ludolf Van Keulen, of Holland, A.D. 1590. He was so elated over his discovery, that he had the figures expressing the symbol of it engraved on his tombstone as his memorial. The proportion of the diameter to the circumference of a circle is the all-important factor in solving this problem. The knowledge of this is so essential to advance mathematical science and mechanic art, that it has received a name and a sign. Just as, for convenience, multiplication is symbolized by a cross (×), and equality by two parallel lines (=), so is this proportion (1 : 3.14159+) represented by the Greek letter pî.

But Ludolf Van Keulen never did discover this proportion to exactness, nor even the true scientific method of solving the problem. He approached as near to it as any other mathematician known to us. But all he really did was to square the many-sided polygon, contending that the quadrature of a circle was an impossibility, like the meeting of two parallel lines. It has remained for the late John A. Parker, of New York, to discover this real mathematical proportion, which, for convenience, we will designate in this article as English (or "Brit"-ish P.) (P.) to distinguish it from Greek pî. And J. Ralston Skinner, of Cincinnati has discovered that the Parker formula was the identical one used by the architect of the Great Pyramid in its construction, and also by Moses and Solomon in the construction of the tabernacle and temple and their contents.

Of course, in ordinary measurements, the pî proportion is near enough for all practical purposes. But in the distances of the heavenly bodies, where the circle of the zodiacal belt and the orbits of the so-called fixed-stars are to be measured, where a unit is multiplied by myriads of quadrillions, it becomes vastly important that we have not only an exact proportion, but a true scientific method of obtaining it. P begins to vary slightly from pî in the sixth decimal figure, thus:

pî ....3.14159265+
P exactly $\frac{20612}{6561}$; expressed decimally..3.14159426+

This Parker formula (P) we illustrate by a diagram in a manner so simple as to be within the comprehension of a child. We inscribe the largest possible circle within a square. Then, *as the area of this square is to four times the area of this circle, so is the diameter of any circle to its circumference.*

In calculating areas of circles and sides of squares, it becomes necessary to square and extract roots. So in simplifying our illustration, we will use that remarkably flexible and almost magical number 9, which is easily squared to 81, and the square root of which is so readily perceived to be 3. And we will consider our diagram (*a*) as representing a square with 81 inches to the side. Now, as the circle is the largest possible within this square, the diameter of this circle equals a side of this square. To find the area of a square, we square a side. To find the area of a circle, we multiply the square of radius by $\frac{20612}{6561}$ (P). The area of a circle of 81 inches to the diameter obtained by 3.14159+ (pî) is 5152.9929975+; but as obtained by P, is exactly 5153, without the slightest fraction. Now the area of this square is 6,561 inches, and four times the area of this circle is 5153×4=20,612 inches, Then, as 6,561 is to 20,612, so is the diameter of a circle to its circumference.

Skinner shows that Moses and Solomon and the architect of the Great Pyramid, used these very measures which we have obtained in this simple manner, in the construction of those sacred edifices. The Parker formula 6561 : 20612 may be expressed in a modified form without changing the proportion, by dividing both by 1,000, which gives us 6.561 : 20.612, and then we have, in the second term, the exact number of inches to the cubit measure, used in the construction of those sacred buildings. According to Smith's Bible Dictionary, the holy place of the tabernacle was 20 cubits long, and 10 cubits broad:

20×20.612=412.240 inches.
10×20.612=206.120 inches.

The king's chamber is:

In length, 412.132 inches.
In breadth, 206.061 inches.

These measurements of the holy place of the tabernacle correspond, to within about one-tenth of an inch, with the measurements of the length and breadth of the so-called king's chamber in the Great Pyramid. This is nearer than any two measures of this chamber have ever agreed.

We would ask any who regard it as heterodox to connect science in any way with revelation, to notice the first verse of the first chapter in the Bible, and read the name there, in Hebrew, of that Being, who, "in the beginning created the heavens and the earth," and then tell us, is it likely that that name of His was conferred upon Him by any of His creatures? If so, by whom, and what did it signify? We must remember that the Hebrews had no figures for numbers, and so they used letters in alphabetical order instead. Letters, therefore, often had a double signification. Was it accidental that the numbers signified by the letsers of that name as seen in our diagram *c*, are 3.1415+, the symbol of the quadrature of the circle? If so, is not such an accident more wonderful than the reality? The circle is not completed with the last figure 5, and plus is the only single symbol that can complete either the circle or the symbol, if expressed there decimally. God's law is the transcript of His nature. And here we

have symbols of that law which governed in all the sacred places, whether in art or in nature.

If it is objected that we begin to read these figures not with the beginning of the word, we answer that the word A-l-h-m, of four letters, represents a square. But the numbers which these letters signify, are the acknowledged symbols of a circle. Now, it is in the circle that we read these figures, and what difference does it make where we begin to read on a circle, which has neither beginning nor end, provided we read according to the Hebrew custom, from right to left. Is it not the more significant of the Being who had no beginning?

Further, a circle is the proverbial symbol of fullness or perfection and eternity, as a square is a symbol of rectitude or righteousness and truth, all attributes of Deity himself, while the unchangeable proportions symbolized, is no less suggestive of immutability. No one calls it a coincidence merely, that the symbol of a pyramid is found in the cartouche of a king of the fourth Egyptian dynasty. It is accepted as evidence that Cheops built it. Is it any less conclusive that the Almighty has revealed to man that symbol of modern science which entered into the construction of all the sacred architecture on earth and in heaven, when we find it in the first recorded name of His, ever written by inspiration?

But, happily, we are not left to the necessity of merely theorizing on this subject. That people have been really inspired from above to construct the sacred architecture which contains the symbols in question, is recorded in Revelation as a positive fact. Bezaleel and Aholiab "were filled with the Spirit of God," to enable them to work in all manner of workmanship, pertaining to the construction of what pertained to the tabernacle of Moses. (See Ex. xxxi. 1—11.)

Now, we are willing to concede that there may have been one chance in a million that this was an accident, within the limits of possibility. So, "at the mouth of two or three witnesses, that every word may be established," we will bring forth a second attest. We will examine that specimen of architecture which is acknowledged to be the most sacred of any work of inspired man on earth, called the ark of the covenant, on which nothing was done without Divine direction in the doing of it. The all-essential thing in a covenant is the signature. Did the Almighty have his signature on and in that ark and its contents? We answer, we find the same symbol that we did in his first recorded name, both in the measures and in the name.

First, let us see the measures, $2\frac{1}{2}$ cubits long, $1\frac{1}{2}$ broad, $1\frac{1}{2}$ deep:

$2\frac{1}{2} \times 20.612$ inches$=51.53$ inches.

$1\frac{1}{2} \times 1\frac{1}{2} = 3 \times 20.612 = 61836$ in.$\div 12 = 5.153$ feet.

So, in the denomination of both feet and inches, we find this peculiar group of figures. And, these figures, 5153 in inches, are the area of our circle of 81 inches in diameter. Now, let us examine the word covenant. In Hebrew it is B-r-y-th. Let us place these letters on the corners of a square of 81 inches to the side, and see if the numbers represented are symbolical of our circle, with 81 inches for its diameter? (Diagram *e*.) It is permissible to omit the ciphers. We

begin with 4, and read 41224. There is no fraction this time, and so we go all the way round the circle, to do which requires the repetition of the first figure. Now, a cube has eight sides, and 41224 is exactly eight times 5153. We have shown that four times this number, 20612, was the other factor in the Parker modulus, which is exactly doubled in this word covenant; and this is not without apparent signification, as the coffer of the Pyramid, which corresponds to the ark of the tabernacle, is double in its outside measures to its capacity measures.

Having found this symbol of the quadrature of the circle in the first revealed name of Almighty God, and also in the Sinai or Law Covenant, we will look next to the Abrahamic Covenant, which the law could not disannul. (See Gal. iii. 17.) We place the four Hebrew letters, which spell Abr'm, at the corners of our square of 81 inches; and, when we get the group of figures, 41224, we see that they are the same as in the word Covenant, and in the same order. But we read from over the circle in one word, and from under it in the other. (See diagrams *e* and *f*.) Read that most wonderfully expressive of all groups of figures in those two words, side by side.

The names of Parker and Skinner, who have given us the clue to these marvelous discoveries of pure and applied science in revelation, deserve conspicuous places among modern discoverers. This cubit of 20.612 inches corresponds nearly to an ancient measure found on a papyrus scroll in the Museum of Turin. Skinner calls the Parker modulus "the creative law of Almighty God, by which he mentally conceived the framework of the mighty worlds composing his house, the universe." In fact, he has discovered rules, based on this formula, by which to determine the sun's angle of parallax and distance and the movements of the moon and earth.

We furnish this article for publication by request, not with the expectation of converting very many to our views. "Can there any good come out of Nazareth?" is the old type of response to unanswerable argument pertaining to the transcendental. We are well aware that our "so called proofs" may be easily disposed of as coincidences, curiosities, or accidents. But, nevertheless, the fact cannot be controverted that the figures, carried out with exactness in order and number to four decimals with a plus, and coinciding exactly to those figures which symbolize the quadrature of the circle, are unveiled in the first revealed name of Almighty God, repeated hundreds of times in the Old Testament, where they have been concealed till J. Ralston Skinner (the author of several mathematical works) discovered them. Expressed decimally, these figures agree to exactness with our P modulus.

Nor is it a less important fact, in harmony with the above, and as corroborating the same truth, that the two covenants for which the Old and New Testament Scriptures are named, contain the symbols of the same mathematical problem.

They solve repeatedly what has been declared by scholars to be as impossible as perpetual motion, and place our good old Bible in connection with the

Great Pyramid (which is older) in advance of all other books, in both pure and applied mathematical science, revealed to us in a way older than all written or oral language, in symbols which are eternal and unchangeable, universally intelligible, without interpretation, alike to the child and the philosopher, the savage and the scholar.

The flippant epithets, "coincidences," "curiosities," or "accidents" are not at all responsive to these facts. Like the successive steps in a geometrical theorem, they become, when so often repeated, what lawyers call cumulative evidence, or what mathematicians call self-supporting.

But it is objected that figures are wonderfully flexible, and that the 666 of Revelation was supposed to refer to the Latin church, till it was learned that they would fit several other names. Suppose they do! Does that unfit them for the object designed as descriptive figures? Have they no discoverable application on that account? This is the old objection to the peculiarities of Moses' rod. The description would apply to the magicians' rods. Did not the words Jesus or Christ fit other persons? But this objection is not relevant to this unique case.

For a more elaborate discussion of this and kindred topics (including the relation of the analytical unit (R°) to this square of 81 inches) we refer to our articles on the Great Pyramid and its symbolisms in the *Baptist Family Magazine.*

NOTES AND QUERIES.

Will some of the readers of the REVIEW, who are versed in our early history, inform me if the Missouri river was explored for any distance by *American* travelers prior to the expedition of Lewis & Clark—if so, by whom and the date.

A. C.

When was that part of Missouri, south of the Missouri river, and west of the Osage boundary line, (line from Sibley south to Arkansas river,) vacated by Indians? The Osages vacated that east of this line and relinquished title in 1808.

G. C. BROADHEAD.

I have seen a newspaper statement to the effect that the Confederate Government, while in existence, did not possess a seal, and that many of the generals who served under it did so without commission, acting under verbal or written assignments. Is the statement true?

ANTIQUARY.

As an evidence of the influence possessed by traders over the Indians formerly inhabiting our state, I will give an incident that occurred among the Osages. About the year 1795, at the instigation of Pierre Chouteau, who had controlled the trade of this tribe for several years, more than two-thirds of them removed from the Osage river to the Arkansas. Chouteau persuaded them to take this step as a revenge on Manuel Lisa, who had obtained from the Spanish authorities the exclusive right to trade on the Osage river. After Louisiana was

ceded to the United State an effort was made to reunite the villages but without success, and later when they ceded their lands to the government they conveyed over twenty millions of acres in the territory of Arkansas. OSAGE.

In Lewis & Clark's Expedition, Vol. 1, p. 17, referring to a stream not far from the Kansas, the following occurs: "To the north are some rocks projecting into the river, and a little beyond them a creek on the same side called Charaton Scarty, that is, Charaton like the Otter."

Can any one tell me the present name of the stream above mentioned? J.

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1. Is there a work on the geographical distribution of prehistoric remains in America?

2. Who can give me the address of the Secretary of the St. Louis Historical Society?

3. The address of the President of the Archæological Institute of America.

T. L L.

Lieut. Pike, who was among the Osages in 1806, says: Chtoka, a little Osage chief, informed him that he was at Braddock's defeat with all the warriors that could be spared from both villages; that they were engaged by Mr. McCarty, who commanded at Fort Chartres, and who supplied them with powder and ball; that the general place of rendezvous was near a lake and large fall (probably Niagara). The Kansas Indians did not arrive until after the battle, but the Otoes were present. They were absent from their villages seven months and were obliged to eat their horses while returning. Can any one cite me to a confirmation of this statement that our western Indian participated in that memorable engagement? OSAGE.

The last number of REVIEW asks the origin of the name Chariton. Lewis & Clark spell it Charaton and say it is a corruption of Thieraton, but say nothing more. Some of the old settlers along that river some years ago informed me that it meant "land rich in honey," being famous land for "bee hunters."

The first survey for the North Missouri Railroad was located and road built along what was known as the "bee trace," a beaten path along the dividing ridge between the waters of the Chariton and those flowing toward the Mississippi. The earlier settlers pronounced the name Charataw. G. C. B.

PUBLICATIONS RECEIVED.

The *Platonist*, Vol. I, No. 2, devoted to the dissemination of the Platonic Philosophy in all its phases: quarto, 16 pp., monthly, Thos. M. Johnson,

Osceola, Mo., $2.00: *Student Life*, Vol. IV, No. 7, a sprightly monthly, edited and published by the students of Washington University, St. Louis, Mo., $1.50: The *Baptist Monthly Magazine*, Vol. II, No. 4, 32 pp. oct., monthly, Philadelphia, $1.00 per annum: Notes on the Crania of New England Indians, by Lucien Carr, published by the Boston Society of Natural History, 1880: Thirty-seventh Annual Report of the New York Association for Improving the Condition of the Poor, 1880: Fifty-third Annual Report of the Ohio Mechanics Institute, 1881: Population and Resources of Alaska, by Ivan Petroff, special agent of the Treasury Department, 1881: The Red Spot on Jupiter, by Prof. H. S. Pritchett, from Proceedings A. A. A. S., Boston, 1880: The Physical Basis of Life, by Prof. T. H. Huxley, Humboldt Library, Vol. I, No. 21, J. Fitzgerald & Co., N.Y., 15c: The *Illustrated Cosmos*, Chicago, Ill., Vol. I, No. 3: The New York School Examination Questions, C. W. Bardeen, Syracuse, N. Y., 25c: The Causes which Produce the Prevailing Winds and Ocean Currents, by C. A. M. Taber, Boston, 1881.

THE TRANSPORTATION OF WHEAT.

The cost per bushel of bringing wheat from the great centers of production and distribution to the leading markets of Europe has been elaborately compared and tabulated as follows by Mr. R. Meyer, in the *Austrian Monthly of Social Science and Political Economy*:

From	To	
San Francisco	England	$0.36@$0.39
The "Far West"	Atlantic Harbor	40
New York	Liverpool	10
Chicago	Liverpool	19
Bombay	England	13
Calcutta	England *via* Suez	18@ 29
Calcutta	England *via* Cape	15@ 20
Australia	England	21
Buenos Ayres	Havre	16@ 20
Odessa	England or Antwerp	13@ 22
Podwolocziska	Delhi	44
Brody	Delhi	42
Brody	Hamburg	39
Ibraila	London	18
Galacz	Hamburg	57
Budapest	Hamburg	31
Budapest	Liverpool *via* Fiume	28
Lemberg	Frankfort-on-the-Main	26
Vienna	Frankfort-on-the-Main	24
Vienna	Fiume	21
Vienna	Trieste	21

From Odessa is shipped the wheat of Southern Russia. Brody, in Northern Galicia, collects the wheat of the upper valleys of the rivers of Southwestern Russia. Lemberg, close by, is the capital of Galicia. Ibraila is the shipping

point of Wallachia. Galacz ships the wheat of the upper valley of the Danube. Budapest is the central point of Hungary, as Vienna is of Austria. It costs nearly as much to carry wheat from Brody to Lemberg, 58 miles (no railway), as it does from Chicago to Liverpool. From Vienna to Trieste is about 250 miles by rail; in cost of transportation it is further than from Calcutta to England around the Cape. California can easily compete with Hungary in the markets of Western Europe, the cost of raising the wheat being the same.

THE MASTODON IN RECENT TIMES.

Prof John Collett, Ph. D., state geologist of Indiana, gives some statistics in relation to the Mastodon, that dispels the notion that these animals did not live in recent times. Archæologists who argue the great antiquity of man upon this planet, based upon the fact that his remains have been found with those of the Mastodon, will be compelled to seek other lines of proof for their theory. We quote from page 385, geological report for 1880. Prof. Collett says:

Of the thirty individual specimens of the remains of the Mastodon (*Mastodon giganteus*) found in this state, in almost every case a very considerable part of the skeleton of each animal proved to be in a greater of less condition of decay. The remains have always been discovered in marshes, ponds or other miry places, indicating, at once, the cause of the death of the animal and the reason of the preservation of the bones from decay. Spots of ground in this condition, are found at the summit of the glacial drift or in "old beds" of rivers which have adopted a shorter route and lower level, consequently their date does not reach beyond the most recent changes of the earth's surface; in fact, their existence was so late that the only query is, why did they become extinct?

A skeleton was discovered in excavating the bed of the canal a few miles north of Covington, Fountain county, bedded in wet peat. The teeth were in good preservation, and Mr. Perrin Kent states that when the larger bones were cut open the marrow, still preserved, was utilized by the bog cutters to "grease" their boots, and that chunks of sperm-like substance 2½ to 3 inches in diameter (adipocere) occupied the place of the kidney fat of the monster. During the past summer of 1880 an almost complete skeleton of a mastodon was found six miles northwest from Hoopston, Iriquois Co., Ill., which goes far to settle definitely that it was not only a recent animal, but that it survived until the life and vegetation of to-day prevailed. The tusks formed each a full quarter of a circle, were nine feet long, twenty-two inches in circumference at the base, and in their water-soaked condition weighed 175 pounds. The lower jaw was well-preserved with a full set of magnificent teeth, and is nearly three feet long. The teeth, as usual, were thickly enameled, and weighed each from four to five pounds. The leg bones, when joined at the knee, made a total length of five and a half feet, indicating that the animal was no less than eleven feet high, and from fifteen to sixteen feet from brow to rump. On inspecting the remains closely, a mass of fi-

brous, bark-like material was found between the ribs, filling the place of the animals stomach; when carefully separated, it proved to be a crushed mass of herbs and grasses, similar to those which still grow in the vicinity. In the same bed of miry clay a multitude of small fresh water and land shells were observed and collected, which were kindly determined by Dr. F. Stein, as follows:

1. *Pisidium*, closely resembling *P. abditum* Halderman. 2. *Valvata tricarinata* Say. 3. *Valvata*, resembling *V. striata*. 4. *Planorbis parvus* Say.

The shell bearing animals prevail all over the States of Illinois, Indiana and parts of Michigan, and show conclusively that however other conditions may differ, that the animal and vegetable life, and consequently climate, are the same now as when this mastodon sunk in his grave of mire and clay.—*Clinton* (*Wis.*) *Herald.*

A TEN-INCH RAILWAY.

One of the most curious railways in the world is the ten-inch gauge road running from North Billerica, Massachusetts, to Bedford. It was at first hooted at by the people, but the road was completed, making a length of about eight and a half miles. There are eleven bridges on the road, one of which is over 100 feet long. The rails weigh 25 pounds to the yard. The road is well built and equipped—one grade is 155 feet. The cars and engines will at first sight create wonder and admiration. Their perfect proportions give them a handsome appearance. They are constructed very near the ground, giving them great advantages of safety. The cars have an aisle with one seat on each side, in the same manner as our ordinary cars have two seats. The length of the cars allows thrity seats, each person having a seat to himself. The cars are supplied with closets, water tank, and heated by steam, and have all the modern improvements. They weigh but four and a half tons, ordinary cars weighing on a average eighteen tons. The trains run at the rate of twenty miles an hour, with perfect safety. The engine is placed behind the tender, giving greater adhesion to the track. They weigh eight tons, and draw two passenger and two baggage cars. The cost of the road was about $4,500 per mile.

PROTOPLASM—NOT AN ULTIMATE SUBSTANCE.

H. J. Reinke (*Botan. Zeitung*, 38, No. 48) has examined protoplasm obtained from *Æthalium septicum*, and discovered in it the following proximate constituents : Plastin (an insoluble albuminoid resembling the fibrins), vitellin, myosin pepton, peptonoid, pepsin, nuclein, lecithin, guanin, sarcin, xanthin, ammonium carbonate, paracholesterin, traces of cholesterin, Æthalium resin, a yellow pigment, glycogen, sugar (non-reductive), oleic, stearic, palmitic, and traces of butyric acids, carbonic acid, fatty glycerides and paracholesterides, calcium stearate, palmitate, oleate, lactate, oxalate, acetate, formiate, phosphate, carbonate,

sulphate (traces), magnesium (probably phosphate), potassium phosphate, sodium chloride, iron (compound not determined), and water. Plastin can be separated by pressure from the liquid portions of protoplasm. The albuminoids collectively scarcely amount to 30 per cent of the dry substance. Hence the supposition that protoplasm consists of albumen must be abandoned, and we must cease to compare a plasma cell with a particle of white of egg.—*Scientific American.*

THE BLACK RACES OF OCEANICA.

Negro forms are figured among the earliest representations of men on ancient monuments. As early as the eighteenth dynasty (seventeen hundred years before the Christian era), the artists of Egypt represented at least five races of negroes. Nigritic types were also figured by the Greeks, Romans, Assyrians, Babylonians and Persians, although none of these people had as extended knowledge of Africa as the Egyptians had. The examination of all the monuments which have come down from antiquity makes it evident that the negro races of Africa and Asia were well known. Scientific investigations of negro characteristics began to be made in the sixteenth century. The first to record one was Albert Durer, who, in 1525, drew a profile of a negro inclosed in a system of lines, of which an oblique and a horizontal line formed at their junction a real facial angle. MM. de Quatrefages and Hamy, in their "Crania Ethnica," begin the study of the negro races with the negroes of Oceanica, and select as their point of departure the Negritos, the most brachycephalic race. The Negrito race proper, which was first observed in the Philippine Islands, has heen found in the interior of the Peninsula of Malacca, the Sunda Islands, and the Andaman Islands. M. Hamy has been able to trace it even to the interior of India.—*Dr. Verneau, in Popular Science Monthly.*

GYMNASTICS AS A CURE OF DISEASE.

Physical vigor is the basis of all moral and bodily welfare, and a chief condition of permanent health. Like manly strength and female purity, gymnastics and temperance should go hand in hand. An effeminate man is half sick; without the stimulus of physical exercise, the complex organism of the human body is liable to disorders which abstinence and chastity can only partly counteract. By increasing the action of the circulatory system, athletic sports promote the elimination of effete matter and quicken all the vital processes till languor and dyspepsia disappear like rust from a busy plowshare. "When I reflect on the immunity of hard-working people from the effects of wrong and over-feeding," says Dr. Boerhaave, "I cannot help thinking that most of our fashionable diseases might be cured *mechanically instead of chemically*, by climbing a bitterwood tree or chopping it down, if you like, rather than swallowing a decoction of its disgusting leaves."

The medical philosopher, Asclepiades, Pliny tells us, had found that health could be preserved, and if lost, restored, by physical exercise alone, and not only discarded the use of internal remedies, but made public declaration that he would forfeit all claim to the title of a physician if he should ever fall sick or die but by violence or extreme old age. Asclepiades kept his word, for he lived upward of a century and died from the effects of an accident. He used to prescribe a course of gymnastics for every form of bodily ailment, and the same physic might be successfully applied to certain moral disorders, incontinence, for instance, and the incipient stages of the alcohol habit. It would be a remedy *ad principium*, curing the symptoms by removing the cause, for some of the besetting vices of youth can with certainty be ascribed to an excess of that potential energy which finds no outlet in the functions of our sedentary mode of life. In large cities parents owe their children a provision for a frequent opportunity of active exercise, as they owe them antiseptic diet in a malarious climate.—By Dr. Felix L. Oswald, *in Popular Science Monthly for May.*

Trouve's utilization of electricity in combination with surgical instruments is bearing fruit. A case is reported from Vienna in which a doctor has succeeded in curing a cancer in the stomach mainly through the assistance rendered by the polyscope in illuminating the cavity of the stomach. The electric probe, which rings a bell when a ball or any metallic substance imbedded in the muscle is reached, is found a valuable acquisition by army surgeons, and an application of the same principle to surgical forceps has enabled a Berlin oculist to save a mechanic's eye, which had received a bit of steel. The case had become so urgent that the eye must be lost unless the piece of metal could be extracted without delay, but Dr. Hirshberg, by inserting a soft iron probe and subsequently converting it into a magnet by passing an electric current through it, withdrew the metallic particle, and saved the eye.

A curious experiment in heat is performed with an apparatus devised by Dr. Grassi. The apparatus consists of three concentric vessels separated by annular spaces about three-fourths of an inch. The outer space is filled with oil, and the inner with water. The oil is heated to a point above 212° Fahrenheit, when the water begins to boil. Oil heated to 300° is then introduced into the central vessel, and falls rapidly to a temperature about that of the boiling water. Dr. Grassi finds that this central oil cools the more quickly the greater the heat of the outer ring of oil—a result seemingly very paradoxical.

EDITORIAL NOTES.

THE paper read by Dr. Halley before the Kansas City Academy of Science at its April meeting, on Good Drinking Water, was a carefully prepared and exhaustive *resumè* of the whole subject, and the suggestions made were eminently practical and appropriate. At the next meeting, Gen. Samuel Bowman will deliver the 5th Anniversary Address and the new officers will be elected.

PROF. SNOW lectured at Chanute last week upon the Mound Builders, and the next day led a small party in opening two mounds near that city.

PROF. O. ST. JOHN has just returned from a short trip to Arizona and Sonora. He says that a complete skeleton of a Mastodon is reported some thirty miles south from Dodge. A small party led by Prof. Lovewell is about to go down and explore the locality for the same.

THE Missouri river, for the past month, has been exceedingly high. The cities of Omaha, St. Joseph and Leavenworth, and many smaller places have been severely damaged. At this place, so far, (April 28,) the river has not overflowed its banks, although Harlem, on the opposite side, is completely submerged, and the water is twenty-three feet and six inches above low water mark by the city directrix: higher than at any time since 1844, when it exceeded the present height by about twelve feet.

LATER.—On April 29th the river overflowed its banks and to-day, the 30th, the water stands at 27.5 feet above low water mark by the government directrix, or 25.5 by the city directrix. Several ice houses have been destroyed and all railroad trains east and north are stopped. No serious damage to life or property, and it is believed that the maximum height has been attained.

IT is proposed to put iron stairways on the outside of the school houses in Baltimore, that are now supplied with but one single stairway within the building. The city has appropriated $10,000 to furnish additional means of egress from such buildings.

COL. HENRY INMAN, of Kansas, has just published a series of sketches of wild western life and adventure, under the title of Stories of The Old Santa Fe Trail, which make up an attractive volume of some three hundred pages. This work will doubtless find a ready sale, as it is written in a vigorous and brilliant style, and comprises many legends and tales in which the western people have a personal interest, while, to the traveler passing across the plains, it will serve both as a guide book and a romance.

WE are indebted to Prof. Lovewell, of Washburn College, Topeka, for an advance copy of the Transactions of the Kansas Academy of Science, 12th and 13th Annual Meetings. It is well arranged and contains many valuable contributions to science. We shall give it an extended notice next month.

IT IS reported that the renowned astronomer, Prof. R. A. Proctor, is to be married at St. Joseph, Mo., during the present month, to a widow named Mrs. Crawley. The recent conjunctions among the heavenly bodies are evidently suggestive to his astronomical mind.

PROBABLY the most acute and exhaustive study ever made of "Demosthenes and Political Eloquence in Greece," is that of Prof. L. Bredif, of the University of France, at Paris. It is at once subtle, comprehensive, and fascinating as the best novel. S. C. Griggs & Co., Chicago, announce for immediate issue a translation of this remarkable

work by Prof. M. J. McMahon, who is, also, an accomplished scholar in both ancient and modern tongues.

PROFESSORS Trowbridge and Smith, both well known to the readers of the REVIEW by their contributions to it, announce a Summer School of Science at Pritchett Institute, Glasgow, Mo., to commence June 20th, and continue five weeks.

PROFESSOR Wm. I. Marshall, of Fitchburg, Mass., who will be remembered by our citizens from his very entertaining lecture upon "The National Park and its Wonders," under the auspices of the Kansas City Academy of Science, has arranged to conduct an excursion party of prominent teachers and scientists to and through that remarkable region this summer, between August 1st and Sep. 5th. Those giving a month to this excursion under Prof. Marshall's leadership, will be most abundantly repaid.

THE Boston Society of Natural History announces that a Sea-side Laboratory, under the direction of the Curator and capable of accommodating a limited number of students, will be open at Annisquam, Mass., from June 5th to Sept. 15th, the object being to afford opportunities for the study and observation of the development, anatomy and habits of common types of marine animals under suitable direction and advice. There will be no attempt, however, to give any stated course of instruction or lectures.

HENRY B. DAWSON, editor of the *Historical Magazine*, gives the REVIEW the following notice in a private lette:

DEAR SIR:—I have received the January 1881, number of your REVIEW, which I have spent an afternoon in examining; and I am very much pleased with it. I fear it is too good to be "popular," and that it does not pay.

THE British government has recently ordered from the Brush Company of Cleveland, Ohio, an electric light for use in the navy, of 100,000 candle illuminating power. It is believed to be the most powerful light ever made by human hands.

AT the meeting of the St. Louis Academy of Science April 4, Dr. Stephens reported upon his examintion of the famous fragments of matter, supposed to be human bones, which were found by Dr. R. W. Boothe in a mine sixty miles from there, at a greater depth than human remains were ever found before, in a deposit of iron. He expressed a decided opinion that there was nothing in the structure of the fragments to demonstrate that they were bones, and he was positive they were of vegetable growth.

PROF. H. S. SHORT, of the Denver University, is said to have made two very important discoveries in electrical illumination: first, that a film of chromium can be made with the best conductive capacity and practically indestructible; second, that the film may be heated by the electric current to the most brilliant incandescence in a globe filled with hydrogen gas, without injuy to either the chromium or the gas, thus overcoming the chief difficulties with which Edison is contending.

THE extensive works of the Kansas City Smelting and Refining Company will be ready to commence operations June 1st.

THE revenue steamer Corwin is to make another cruise in the Arctic seas in search of the Jeanette expedition. The regular relief expedition provided for by congress will go to the West after passing through Behring's strait. The Corwin will go to the East and search the region about Point Barrow.

MR. RAMON VEREA, a Spanish resident of New York, has been devoting his leisure hours for several years in developing a machine that will multiply and divide, and it is said, has finally succeeded.

THE naval officers composing the Jeanette relief board have completed their work and submitted their report to the Secretary of the Navy. The report recommends that the Mary and Helen should leave San Francisco about June 1, to arrive at Herald Island by the middle of August, and examine the coast

of Siberia. The steamer should winter at some harbor on the southern or southeastern end of Wrangels Land or on the Siberian coast as near as possible to Wrangels Land, so as to make the sledge journeys to the east coast of Wrangels Land. They should not remain in the Arctic more than one winter.

The report closes with an expression of belief that the Jeanette should be considered safe until news of disaster is received.

A Scottish scientist has discovered in the course of his investigations that there was an industry pursued in the north of Scotland that was, in its elements, as ancient as that of the potters of Etruria. In a small district he found that certain pottery—vessels known as kraggans—were still being manufactured, and an old woman who stated that she had inherited the art from ancestors buried long years ago, made the old-fashioned vessels. They were all perfect, and the surrounding peasantry looked upon their maker with considerable reverence. The molding was done with a peculiarly bent stick, and not with any instrument like the potter's wheel.

ITEMS FROM THE PERIODICALS.

The Leavenworth *Standard* has published several articles describing certain lately discovered remains of ancient earthworks near the Fort and is of the opinion that they are on the site of the battle fought between the Spaniards and the Missouris in 1719, described by Mr. John P. Jones in the last number of the Review. Further investigations are being made by competent and enthusiastic gentlemen, such as Judge Adams of Topeka, Dr. A. J. Brown and Judge Mann of Leavenworth, the result of whose labors we shall present to our readers as soon as it assumes a reliable form.

The New York Entomological Club has commenced the publication of an organ with the title *Papilio*, to be issued on the 15th of every month and devoted solely to the Lepidoptera. $2 00 per annum.

The *Illustrated Cosmos*, edited and published by Everett W. Fish at Chicago is "designed to represent the relation of the living church to the great questions developed by modern physics and philosophy." It is a handsome quarto, well illustrated, and issued monthly at the price of $1.50 per annum.

The Telectroscope is an apparatus intended to transmit to a distance over telegraphic wires pictures taken on the plate of a camera. It was invented by M. Selencq, of Ardres, in 1877, and has been perfected. A very full description of it is given in the *Scientific American Supplement* for April 9, 1881.

The *Atlantic Monthly* for May, 1881, presents the following attractive table of contents: "Some Personal Recollections of Carlyle, Henry James; Rabbi Ishmael, John Greenleaf Whittier; The Martrydom of an Empire, E. H. House; The Portrait of a Lady, XXV.-XXVIII, Henry James, Jr.; Three Sonnets, I. Nativity, II. Circumstances, III. Providence, J. T. Trowbridge; Study of an Old Southern Borough, Walter H. Page; Reminiscences of Washington, XII, The Fillmore Administration, 1859-1853; Friends: A Duet, XI.-XII., Elizabeth Stuart Phelps; Eugene Scribe, J. Brander Matthews; Lawn Planting for Winter Effect, Samuel Parsons, Jr.; Demeter's Search, Edith Thomas; Correspondence With a British Critic, Richard Grant White; The Head of Medusa, and other novels; The new edition of Gilchrist's Blake; The Contributor's Club; Books of the month."

From the many interesting articles in the May *Harper*, we select as most appropriate and seasonable, those on George Eliot, Thomas Carlyle and others, Athens and the Greeks of To-day, and MacCook's Camp Lou.

The *Independent Practitioner* is a monthly journal, devoted to medical, surgical, obstretical, dental, hygienical and popular science, edited by Harvey L. Byrd, A. M., M. D., and Basil M. Wilkerson, D. D. S., M. D., No. 68 North Charles street. Subscription, $3.00 per annum, in advance.

OUR former correspondent, Rev. James French, is contributing a series of (illustrated) articles upon The Great Pyramid, to the *Baptist Family Magazine*, published at Philadelphia, by Rev J. Eugene Reed.

THE most interesting articles in *The North American Review* for May are those on "Centralization in the Federal Government;" "The Life-saving Service," by the Hon. S. S. Cox; "The Ruins of Central America," by M. Charnay; and, finally, an attack on evolution philosophy, written in a vein of the finest irony, and entitled, "What Morality Have We Left?"

POPULAR SCIENCE MONTHLY, contents for April. The Development of Political Institutions, by Herbert Spencer, VI. Political Heads—Chiefs, Kings, etc; The Black Races of Oceanica, by Dr. R. Verneau, (illustrated); Physical Education, by Felix L. Oswald, M. D.; Out-door Life; History of Chronolgy, by Prof. E. S. Burns; Some Notes on a Doctor's Liability, by Oliver E. Lyman, Origin and Structure of Volcanic Cones, by H. J. Johnston-Lavis, F. G. S. (I,) (illustrated;) Man and the Vertebrate Series, by Charles Morris; The Relative Hardness of Plants, by Samuel Parsons, jr.; What is a Cold, by a Medical Man; The Purification of Sewer Waters, by M. E. Aubrey-Vitet; Mr. Frank Buckland, by Spencer Walpole; The Felicity of Naturalists; Plantation Folk-Lore, by Prof. T. F. Crane; An Ancient Scientist; Literary Notices; Sketch of Michel Chasles (with portrait;) Popular Miscellany; Notes.

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ASTRONOMY.

COMING ASTRONOMICAL EVENTS.

BY EDGAR L. LARKIN, NEW WINDSOR OBSERVATORY, ILLINOIS.

Within a year, newspapers have published sensational accounts relating to impending evil, and have spread the delusion that calamities were about to fall on man, owing to the configuration of the planets. A spirit of astrology seems to have arisen even in the midst of the light of science, and late astrologers have endeavored to fill the public mind with needless fear. Wars, famine, pestilence, earthquakes, deluges and hurricanes, so say the prophets, are to be of common occurrence during the years 1881–82 The planets will become portentous, will assume ominous positions, while the Earth, wandering in space alone, will be under malign influences, making millions die. The critical period is set for June 19th, 1881, when more planets will be on the same straight line with the Earth, than has occurred during centuries of time.

It cannot be denied that on the day mentioned, the bodies forming the the solar system will be arranged in unusual positions. All the power of the attraction of gravitation existing in the system will be exerted against the earth, and the combined force will have *tendency* to draw it nearer the sun.

If, on June 19th, a line be drawn from the first point in Aries, through the center of the Sun, to the first of Libra, the solar system will be divided into two equal parts, when Mercury, Mars, Jupiter, Saturn, Uranus and Neptune will be on one side, with only the Earth, Moon and Venus on the other. Venus and the Moon will

have more effect against the Earth than if actually on the opposite side of the line, because nearer, they will attract with greater power, and the direction of their attraction will be the same as that of the Sun and all the planets.

True, our little world, an atom in the Universe, will whirl in lonely voids, with no planet near to aid her against the united power. Our home will be literally isolated in space, and all the forces of nature are now conspiring for a grand opposing effort on the day before the summer solstice. The effect on the Earth will be the same, nearly, as though the Sun on that day should be made heavier by the addition of a weight equal to that of all the planets and satellites. In this note the influence of the Asteroids will be ignored, as their masses are too small to effect any conclusion that may be made.

To make the matter plain, we have drawn up a diagram of the solar system as it will appear on the day in question. For want of astronomical type and characters, we have substituted initials :

SOLAR SYSTEM, JUNE 19th, 1881.

SN.—Real place of the sun.
AS.—Apparent place of the Sun among the fixed stars, as seen from the Earth.
My.—Real place of Mercury.
MY.—Apparent place of Mercury as seen from the Earth.
VS.—Real place of Venus.
V.—Apparent place of Venus as seen from the Earth.
E.—Real place of the Earth.
AE.—Apparent place of the Earth as seen from the Sun, or in heliocentric longitude 268° 30′.
MO.—Real place of the Moon.
MOO.—Apparent place of the Moon among the stars as seen from the Earth.
MS.—Real place of Mars.
M.—Apparent place of Mars among the stars, as seen from the Earth.
JU.—Real place of Jupiter.
J.—Apparent place of Jupiter among the stars, as seen from the Earth.
SAT.—Real place of Saturn.
S.—Apparent place of Saturn among the stars, as seen from the Earth.
UR —Real place of Uranus.
U.—Apparent place of Uranus among the stars, as seen from the Earth.
NEP.—Real place of Neptune.
N.—Apparent place of Neptune among the stars, as seen from the Earth.
P.—North pole of the heavens, or axis of the Earth produced.
PL.—The Pleiades.
A.—The star Aldebaran.
C.—The star Castor.

The outside circle ruled to degrees, and divided into twelve portions, is the concave surface of the celestial vault, or that part of it called the Zodiac. The printed page of the REVIEW is the plane of the ecliptic, or the plane of the Earth's orbit extended to infinity. The Zodiac is 16° wide, hence the reader must imagine 8° below and 8° above the surface of the paper. The twelve signs read all the way round, beginning at Aries, and reading from west to east. All the interior circles are the orbits of the planets. It will be understood that the orbits

C
A
PL
NORTH
SOUTH
CANCER
GEMINI
TAURUS
ARIES
PISCES
AQUARIUS
CAPRICORNUS
SAGITTARIUS
SCORPIO
LIBRA
VIRGO
LEO
NEP
JU
SAT
P
UR
MY
SN
MS
VS
MO
E
AS
AE

are not in proportion, that of Neptune would be far beyond the limits of the page; but the positions of all the bodies are correct. To those who do not make astronomy a study, we suggest that they face south, and lay the REVIEW flat on a table. The north point of the engraving will be toward the south. Place a watch on the Sun, with the 12th hour directed toward the word North, when it will be seen that the motion of all the planets is in a direction opposite to the movement of the hands. Since the page is the plane of the ecliptic, the north pole of the Earth's orbit must be perpendicular to it. The post of the watch is then the axis of the ecliptic. Attach a key, reverse the hands, and the motion of the solar system will be represented. Call the post a pencil long enough to reach the ceiling, it would mark a point thereon directly over the center of the Sun in the cut, and the line will be the axis of the ecliptic, and the point its pole. Call the axis of the Earth another long pencil, then it would make a mark on the ceiling represented in the cut by the point at P. This is the north pole of the equinoctial or Earth's equator extended infinitely. The two points on the ceiling are 23½° apart. Imagine the pencils extended to the celestial vault, and we can learn where the poles are located in space. The pole of the equinoctial is in north declination, 88° and 40′, only 1° and 20′ from the star Polaris; of course it has no right ascension. The pole of the ecliptic is in Draco, dec. north 66° 30′ and always in R. A. 18 hours. In the cut the axis of the Earth, prolonged, cuts the celestial dome at P. This is because the Earth's axis always leans towards the first degree of Cancer, or in the direction of the figure 6, throughout every revolution around the sun.

On the day of the summer solstice, in order for the pole to incline towards the first of Cancer, it passes over the Sun, as may be seen by inspection. In space there are no such directions as north, south, east, west, up, down or over. These terms are used relatively to the Earth, and in treating of infinite voids all such ideas must be dispelled from the mind. When the poles of planes are inclined, the planes must be inclined in exact proportion. As the pole of the Earth leans 23° 30′ from the pole of the ecliptic, so these planes are inclined by the same amount. Since, in the cut, the point P. is inclined from the point SN., towards the north or the top of the book, and as the paper is the ecliptic, the plane of the equator must be depressed below the page, toward the top of the REVIEW, and elevated above it, in that part of the page nearest the reader, in amount equal to the distance between P. and SN. A tangent to the orbit of the Earth may be imagined to be drawn from the number 13 in Libra to 23 in Pisces, passing through the Earth's center. This may be taken, without sensible error, to represent the line of the Earth's equator. Revolve it about the center of the Earth as a center, and it will generate a plane in infinite space. This is the plane of the equinoctial. As this is at right angles to the axis of the Earth, and as this plane points towards P., the plane is depressed below and elevated above the paper, along the line from Pisces to Libra, as above indicated. Then, on the 19th of June, the entire solar system will be in north declination, the Sun and all the planets being north of the equator of the Earth.

Here are the declinations taken from the United States Almanac, every one being north; Sun, 23° 26′; Moon, 7°; Mercury, 22° 9′; Venus, 13° 24′; Mars, 9° 37′; Jupiter, 15° 37′; Saturn, 12° 19′; Uranus, 8° 28′; Neptune, 14° 52′.

But this is no cause why astrologers should seek to create alarm. It is true that when all the planets are on one side of the equator, they will exert an influence to lessen the angle between the ecliptic and equinoctial, or, in other words, draw P. nearer to SN. The equatorial diameter of the Earth is 26 miles greater than the polar; this makes the equatorial protuberance 13 miles high all around the Earth. There is more matter to be attracted about the equator than at the poles. The excess of attraction from the Sun would, in time, make P. and SN., or the ecliptic and equator, coincide, were it not that the earth spins on its axis. The force generated by axial rotation counteracts the attraction on the bulging equatorial region, thus giving stability to the direction of the Earth's axis and plane of the equator. This is called the persistency of the plane of rotation, and may be studied by anybody who has a perfect gyroscope. But the force evolved by the axial rotation of the Earth is not exactly sufficient to overcome the excess of attraction. The two planes do tend to approach, but instead of doing so, the equinoctial slides around on the ecliptic from east to west, contrary to the order of the signs.

The amount of this retrogradation is 50″ annually, and has amounted, since its discovery by the Greeks 2,000 years ago, to a whole sign. Everybody knows that the star Castor is in Gemini, but in the cut it appears in Cancer, its true position in reference to the signs. The stars in Gemini occupy the sign Cancer, those of Cancer the sign Leo, and so on around the heavens. In the summer, therefore, of 1881, all the bodies in the solar system will join in the endeavor to make the ecliptic and equator coincide. This would, in time, put an end to the changes of the seasons; give to all places equal in latitude a climate that would remain invariable, and would doubtless destroy multitudes of the human species.

Astrologers who have not grasped the full meaning of the laws of gravitation and motion, fill the papers with ominous prophecies of approaching danger.

There is not the slightest cause for alarm; all that the planets can do, no matter where they are in their orbits, is to cause a minute increase in precession, so far as their declinations are concerned. This we have seen is 50″ annually, an arc so small as to require mathematical instruments to measure it. The total augmentation of precession the planets are able to cause, is less than $\frac{1}{745}$ of 50″, provided they maintain their united effort throughout the year! But they cannot be in combination longer than the length of the day—the 19th of June. True, they will be in north declination longer, but their directions will be so changed, that by resolution and composition of forces, they will have less than their maximum attraction on the equatorial elevation of the Earth. Their maximum power acting during a year would be less than the small amount mentioned, a displacement of the equinoxes so minute as to be incapable of measurement.

So much for the troubles to be caused by planetary declinations; now for the woes to be brought about by their right ascensions. "Achilles' wrath to Greece," was not more prolific of tribulations than are to be the aspects of the planets in June. They are to congregate in the same part of the heavens, and start up a tidal wave, magnetic or electric, that shall surge against the earth and make the nations mourn. If the reader should journey into space in the direction of the pole of the ecliptic on the fated day, far enough to look back and secure a good view of the revolution of all the planets, the "collocation of the spheres" would appear as laid down in the engraving. Sure enough the earth is seen wandering alone, away out in heliocentric longitude 268° 30′, and no helping orb is near. Venus, Jupiter and Neptune are precisely on the same straight line with the Earth, all centered in the fourteenth degree of Taurus; Saturn, Mars, and the Moon, are nearly in the same direction; Venus and Saturn are quite near the same right line, while Mercury and Uranus are east of the Sun; but, all save the Earth, Venus, and the Moon, are north of the line running from Aries to Libra,—the Equinoctial Colure. The line running from Cancer to Capricornus is the Solstitial Colure, across which the Earth will pass the next day after the eventful June 19th, when the Earth will enter the sign Capricornus, and the Sun, Cancer.

The Solstice occurs on June 20th, at fourteen hours. As astronomical time begins when the mean Sun is on the meridian, fourteen hours, June 20th, is equal to 2 o'clock a. m., June 21st, at which time to the observer in space, the pole of the Earth's equator, the pole of its orbit, and the first point in Cancer will be on a line as can be seen in the diagram. Thence it is to be observed that the cut is arranged for noon, June 19th, Kansas City time. The north pole of the Earth is leaning toward the Sun; the Moon is setting, and Uranus has already advanced above the eastern horizon. The figures outside the Zodiac beginning at 1, 2, 3, and counting from west to east to 24, or no hours, are hours of right ascension, which is the same as saying the angular distance of a celestial body from the first of Aries, measured on the equinoctial. Each sign is equal to two hours of time, each hour to 15° of space, or sixty minutes, so that each of the degree spaces is equal to four minutes of time. The straight lines drawn from the Earth through all the planets, and produced to the celestial vault, are drawn simply that the reader may learn where they will appear to be as seen from the Earth; and that he may know that the right ascensions are correct. Here are the right ascensions of the planets on the direful day.

Sun, 5 hours 53 minutes; Moon, 15 m.; Mercury, 7 h. 42 m.; Venus, 2 h. 55 m.; the Earth,—longitude 268° 30′; Mars, R. A., 1 h. 48 m.; Jupiter, 2 h. 54 m.; Saturn, 2 h. 29 m., Uranus, 10 h. 48 m.; and Neptune, 2 h. 54 m. It will be seen that the R. A. of Venus is 2 h. 55 m.; Jupiter, 2 h. 54 m.; and Neptune 2 h. 54 m., only one minute difference. So we draw a straight line from the Earth through all of them. The law of gravity is this:—

"Every particle of matter in the Universe, attracts every other, directly as to mass, but inversely as to their distance squared."—Newton.

The joint attraction of the whole solar system, acting on the Earth is to draw P. to SN., which has been shown under the head of declinations to be inappreciable. The combined power of the Moon, Venus, Mars, Jupiter, Saturn and Neptune, will aid the Sun in its attempt to draw the Earth nearer to its mighty mass. But these same planets at the *same* time, tend to accelerate the orbital velocity of the Earth. Hence our world will not be affected at all. It can neither fall nearer the Sun, nor move faster. The astrologers make no account of inertia, inherent in the Earth and all matter. The planets help the Sun attract the Earth, and help the Earth to resist it in equal proportions. Increased velocity enables inertia to re-assert its powers, and appear as a force called the centrifugal. Since the same bodies that cause the attraction also cause the opposing force, both must be equal, and we shall continue our flight through space as though nothing had happened.

The student of physics, gravity, motion and geometry, knows that any number of forces are capable of resolution in the direction of diagonals, of parallelograms, rectangles, parallelopipedons and similar geometrical figures. He can take the cut and draw up a series of such figures by the rules of resolution and composition of forces, in relation to the Sun, the Earth and any planet, and in doing so will find that all the planets aid the Sun by increasing its attraction on the Earth. This is as it should be, because the Sun is the center of gravity of the system. Now draw similar figures relative to the Earth, and its motion in relation to the Sun, and the diagonals of the whole series of drawings will be in equivalent ratio; hence, the Earth will not be disturbed on that awful day.

Uranus and Mercury serve to retard the Earth, thereby enabling the Sun to attract with greater effect. Therefore their action may be called the residual of force remaining in the entire solar system that is at liberty to effect the Earth. As the forces of all the planets west of the Solstitial Colure, and therefore west and north of the Earth, are neutralized, the feeble attraction of Uranus and Mercury alone remains to cause wars and plagues. And the perturbation of the Earth from the action of these planets will be so slight as almost incapable of detection by accurate astronomical instruments. Really the Earth is not in such a dangerous position as it was on Oct. 7th, 1880, when Jupiter was in opposition. October 7th was a fine day. The Earth in June will be near its aphelion; and acceleration would not bring calamity; even if in perihelion, it should suffer increase of velocity, we should be in no danger. Equal areas are described by the radius vector in equal times; the laws of nature are invariable, and all perturbations are corrected. If all the planets in the system were on a straight line with the Sun and opposed to the Earth; or, if they were all placed on the Sun, the attraction of the solar mass would be increased by less than the $\frac{1}{745}$ part. The mass of the Sun is 745 times greater than the combined masses of all the planets and satellites. Take a stone weighing 746 pounds, break off one pound and the ratio will be that of the Sun and planets. Any force whatever the planets are able to lend the Sun as against the Earth, is *less* than $\frac{1}{745}$, because

the mass of the Earth itself is included in the pound broken from the original weight. Will the Sun that sustains our lives be malignant on June 19th? Because several planets are on line will the chemical constituents of the terrestrial atmosphere be changed to cause pestilence? How can planets cause storms on the earth, or earthquakes? Even the tides will be no higher on that inauspicious day than usual; how then can the crust of the Earth be moved? And what politicians are making ready to precipitate a war in mid-summer because Venus, Jupiter and Neptune are now exerting influence upon them? What modes of force reach the earth from the planets? There are known to be two,—gravity and light. The spectroscope shows that their light consists of reflected solar rays. They are globes something like the Earth. What malignant power leaves the Earth to produce destruction on Jupiter? Does magnetism reach us from the planets? When terrific storms rage in the Sun, it requires a sensitive magnetograph to detect the magnetic influence reaching our world; the telegraphic instruments are effected, and in the evening we are favored with a harmless auroral display. Should all the planets aid the Sun in generating a magnetic disturbance on the Earth, their assistance would be less than $\frac{1}{745}$ of its intensity. Anybody can become an astrologer on an hour's notice. All that is necessary is to procure the U. S. Nautical Almanac, look along the columns of right ascensions, until two planets are found to have the same, and predict a storm, war, or famine for the date. Then if it rains at Cape Horn, or the Turks and Russians fight, the prophecy is fulfilled. On September 25th, 1880, Jupiter was in perihelion, and in opposition a few days later, on October 7th, while Saturn was in nearly the same direction. Jupiter was at its nearest possible point to the Earth, and our little world was in direct line of malignant influence. Yet the weather was excellent, the air fine, and well suited for telescopic work. At the most dangerous period we were engaged for hours in making close examination with high magnifying powers, of every portion of its disc, to see if any changes were wrought on Jupiter by its approach to the Sun and Earth. We saw none take place while looking, but on the following night detected several that had occurred during the interval, all minute, however. But there are instances recorded where movements have been seen to take place in a few hours; therefore, the attraction of the Sun produced no marked change on Jupiter during its last perihelion, though aided by the Earth. We conclude that planetary convulsions arise from forces inherent in themselves, and not from attraction or electricity from the Sun. And then, how can electricity produce vortices in the atmosphere of the planets, when it has to traverse a non-conducting vacuum to reach them from the solar battery? The Earth has been in trouble before. On February 28th, B. C. 2446, the Earth, Moon, Mercury, Mars, Jupiter and Saturn, were all in line in Pisces, as is recorded in Chinese annals. M. M. Desvignoles and Kirch made calculations, and found that such conjunction did occur. But the Chinese astronomers made a fatal omission, —they did not tell us whether it rained on that day.

On September 15th, A. D. 1186, the Earth, Mercury, Venus, Mars, Jupiter

and Saturn, were ranged in line in Virgo. If the Earth left its orbit, it managed to find it again. Many similar conjunctions are on record. (See Chamber's Astronomy, pp. 48–49.)

Have the astrologers heard of this eternal law? If the mass of each planet be multiplied by the square of the tangent of the orbit's inclination to a fixed plane, and this product by the square root of the mean distance, the *sum* of the products thus formed will be INVARIABLE."—*La Grange.*

This is the law of the invariable plane; it lies near the orbit of Jupiter, and insures the stability of the solar system. Instead of fearing the planets, we love their solemn influence, and at midnight hold communion with them, while watching the transits, eclipses and revolutions of their satellites. In place of ascribing to them baneful influence on man, we think their contemplation will make men better, and inspire all who study the laws of their motion with exalted sentiment. We see nothing in planetary position on June 19th, or at any other time, to cause man to distrust nature. And we are willing to place full confidence in those admirable laws that are known to rule with rigor every movement of that vast machine, the solar system.

NOTE.—To Students in School just beginning Astronomy: Should it be desired to use this diagram at noon on June 19th, proceed as follows: Lay the Review on a table as before, the north point toward the south. Procure two straight sticks, say one of walnut and the other of pine; lay them on the table side by side, in direction north and south. They will be nearly in the plane of Solstitial Colure —exactly next day. Look on a map and find your latitude. Tie a string to the pine stick, pass the other end of the cord over the hanging lamp, and draw up the end of the stick in degrees equal to the latitude, and make it fast. The stick will be parallel to the Earth's axis, and will be pointing to the pole of the heavens. This is because the altitude of the pole equals the latitude of the place. Elevate the north end of the walnut stick in the same manner, but suspend it 23½° below the pine stick. It will point to the pole of the ecliptic. It will be noted that the pole of the heavens is between the pole of the ecliptic and the Sun, because the planes are inclined, and because the pole of the Earth leans toward Cancer. Hold the engraving close to the walnut stick, at right angles to it, and the whole solar system in its position at noon, in relation to your own meridian, will be delineated.

MAY 15TH, 1881.

LUNAR ECLIPSE AND OTHER PHENOMENA FOR JUNE, 1881.

BY W. W. ALEXANDER.

Total eclipse of the moon June 11th and 12th, 1881:

	d.	h.	m.	
Moon enters Penumbra, June	11	9.	56.5	Kansas City mean time.
Moon enters shadow	11	10.	52.3	" "
Total eclipse begins	11	11.	54.6	" "
Middle of eclipse	12	00.	35.5	" "

Total eclipse ends	12	1.	16.4	Kansas City mean time.
Moon leaves shadow	12	2.	18.2	" "
Moon leaves Penumbra	3	3.	13.7	" "

Magnitude of the eclipse, 1.365 (moon's diameter, 1).

This is the first total eclipse of the moon visible at Kansas City during many years past, therefore it is quite proper to briefly describe the cause and appearance of the phenomenon.

Every one familiar with the moon's motion knows that it performs its journey around the earth in nearly 29½ days, and if its path lay in the plane of the ecliptic we would have a total eclipse every month, but this is not the case, as its path is inclined about 5° to that plane, one-half of its journey is performed above it and one below it; hence, at certain times (twice in each revolution) the moon is in that plane, at those parts of it called the nodes. Now if the moon at that time happens to be full, that is, in line with the earth and sun, we shall have a total eclipse of the moon. This happens on the evening of the 11th, so at 9 h. 56.5 m. we shall see the moon's eastern side slightly dim as she enters the penumbra. When the umbra is reached the eastern edge will become almost invisible; the circular shape of the earth's shadow will be then distinctly seen as the moon advances; by 11 h. 54.6 m. it is entirely in the umbra or shade of the earth, but if the night be perfectly clear it will not disappear entirely, owing to a sufficient quantity of the sun's light being reflected by the earth's atmosphere towards it to render it faintly visible, and tinge it with a ruddy color; at 1 h. 16.4 m. this phase ends and the eastern edge will become more illuminated by entering penumbra when the circular shape of the earth's shadow will again be seen, but reversed, *i. e.*: its convex side will be turned east. By 2 h. 18.2 m. it will be out of the umbra, and by 3 h. 13.7 m. the western edge leaves penumbra and the eclipse is over.

POSITION OF THE PLANETS.

Mercury reaches its greatest elongation east from the sun on the 19th, and will be visible in the West for a few days, before and after that date.

Venus, Jupiter and Saturn will form many beautiful and interesting triangles this month. On the morning of the 6th, Venus and Saturn will be within 11° of each other or about one-third the diameter of the moon. Venus will be to the north of Saturn. On the 11th, 12th and 13th they will be nearly equidistant from each other, Venus being about 2° south of a line drawn between Jupiter and Saturn.

On the morning of the 19th, Venus and Jupiter are in conjunction, Venus being south 2° 15′. Neptune is also in conjunction with Jupiter and Venus at the same time being nearly midway between them.

Uranus will be in the constellation Leo in nearly the same position as during the month of May, being favorably situated for evening observers.

CHEMISTRY AND METALLURGY.

CHEMICAL AND DYNAMICAL GEOLOGY.

BY ERASMUS HAWORTH, CLASS OF '81, KANSAS STATE UNIVERSITY.

It is so common for students who are specialists to prepare theses showing the results of original work, that one hesitates to present anything which does not strictly conform to this custom. But time is often quite as profitably spent in learning that which has already been discovered, in comparing the views of different scientists on the great questions which are yet unsettled, and in choosing from these that which seems most reasonable, as in trying to enter new fields of investigation. The investigations which are richest in results are made by those who have a general idea, at least, of all the important facts and theories pertaining to their department. It is easy to see how a young man, ambitious to gain a reputation, may rush into original work before he is able properly to assimilate the truths that may be presented to him. In the following pages, therefore, there will be no attempt to present that which is new, but only to express in a somewhat orderly manner a few thoughts on chemical and dynamical geology as advanced by others. Occasionally I may offer objections to certain hypotheses, or draw conclusions that I think would follow from given conditions.

If we accept the nebular theory we are carried back to a time when the earth with all that now belongs to it was in a gaseous condition. No man can follow with absolute certainty the different phases through which it passed in being brought to its present state. To the chemist and the physicist alone remains the privilege of even attempting to say what must have resulted from the continual radiation of heat from this aggregated gaseous body. Moderate heat generally assists chemical action, but it is well known that an intense heat tends to break up chemical compounds. The furnace assay of gold and silver is based upon this fact. These metals are frequently found in chemical union with other elements. The heat of the furnace overcomes this union, drives off the other elements and leaves the gold and silver. From analogy we reason that the formation of compounds, however stable they may be in the hands of man, would have been prevented by the heat necessary to hold the materials of the earth in a gaseous condition. As this mass cooled by the radiation of heat, the time would come when the most stable compounds could exist. We may safely say that such compounds would then be formed. These would be the oxides of calcium, magnesium, barium, aluminum, iron, copper, silicon, and perhaps the oxides of the alkaline metals. The surface radiation would produce a superficial low temperature, so that some particles might be condensed to the liquid or solid state. They would then become intensely luminous, presenting an appearance similar to

that of the solar photosphere. Being more dense than the surrounding gases they would sink toward the center. This would bring them again into a great heat which would revolatize them. While this was repeating itself at the surface, the great pressure at the center would tend to liquefy the gases, and afterward to solidify all those liquids which continually contract on cooling. This is an important point, first pointed out by Hopkins who, from mathematical calculations, proved that while the mass was yet gaseous or liquid, the pressure must have been sufficiently great to solidify the center.

We have similar examples almost every day, when the different gases are liquefied or solidified by artificial pressure. So long as this mass remained in the gaseous or liquid state, the heaviest portions would sink deepest from the surface. We may therefore safely conclude that the center of the earth is composed of the heavy metallic oxides, possibly with some of the most refractory metals in the native state. In the course of time the temperature would be sufficiently reduced for the oxides of carbon, sulphur, and hydrogen to exist. These with the haloid elements, nitrogen and perhaps an excess of free oxygen, would remain in the outer portion of the gaseous envelope.

Portions of the water formed would be decomposed by the chlorine, forming chlorhydric acid. Other portions would subsequently unite with sulphuric oxide to form sulphuric acid. When the temperature was sufficiently reduced, a crust would be formed on the outside of the liquid mass, so that solidification would be going on from the inside out and the outside in, with a great mass of liquid matter between. These being the conditions it is easily understood how the solid crust and all beneath it would be perfectly anhydrous, the basic oxides being united with silicic oxide to form innumerable silicates.

It has been argued that the nebular theory could not be true, because, if the elements had ever been free to move among themselves, they would have united with reference to their greatest affinities, so that a sort of chemical stability would have been formed. Such arguments only betray a lack of chemical knowledge. The oxides of the bases together with the oxides of silicon, and perhaps of boron also, would have been formed, as I have tried to explain, under such conditions as to entirely separate them from water and the volatile acids; so that the formation of hydrated salts, of chlorides, bromides, iodides, fluorides, nitrates and sulphates, would have been impossible. In predicting chemical changes one should carefully consider the environment. Temperature and pressure have a wonderful influence. This outer crust of the earth, resting on the liquid beneath, would be affected by contraction resulting from continual cooling, so that it would present a very irregular surface. As soon as the temperature would permit, the watery vapor, charged with the acids until then existing in the air, would be precipitated in enormous floods.

At the present time, when all the rain water must previously be vaporized by the heat of the sun, according to Loomis, a flood of fifteen inches has fallen in six hours. At tbat time, when all the waters of the ocean were held in vapor, the

precipitation must have been immensely greater. In addition to the mechanical erosion, a mighty chemical action must have begun which, assisted by the heat from beneath, probably surpassed anything our fancy can picture. A half bushel of unslaked lime, when treated with the proper amount of water, generates heat enough to set on fire dry wood that may be in contact with it. How great then must have been the chemical action when these liquid acids were first brought in contact with the earth. It has sometimes appeared to me that it would have been impossible for this primitive crust to be so acted upon as to furnish material sufficient for sediments to bury it so deeply that no portion of it can now be found; but this trouble entirely vanished when I considered the immense acid floods that must have fallen on this primitive crust which was already of an irregular contour. The action of the acids would not have ceased until their affinities were satisfied. The chlorine would then mostly exist in the form of chlorides of sodium, calcium and magnesium; the sulphur in the form of sulphates. Sulphides could not then exist, because the sulphur had been oxidized. Great quantities of silica would be left uncombined by these actions, the bases of the silicates having united with the stronger acids. This would furnish quartz for the many sandstone deposits so common in all geologic ages. Soon after rain began to fall the atmosphere would be reduced to about its present condition, with the exception of the large amount of carbon di-oxide that it would contain. In comparison with chlorhydric acid this gas is but slightly soluble in water, and would therefore be removed from the air much more slowly. Perhaps this is a proper place to remark that the question of the source of the carbon and the oxygen of the earth is a very perplexing one to all speculators. We can only conceive that everything was oxidized to the greatest extent in primitive times. Hence the deoxidation caused by the growth of plants and the reduction of sulphates to sulphides would have liberated great quantities of oxygen. So far as we now know, the only ways for oxygen to be removed from the air are the oxidation of organic matter, the change of binary to ternary compounds, and the change of certain "ous" salts to the "ic" condition. But this is only replacing it where it originally belonged, so that it really is removing nothing from the sum total of the oxygen in the air. It has been estimated by different scientists that if the carbonaceous matter now in the earth has been reduced from carbon di-oxide, it must have liberated more than twice the amount of oxygen now in the air. But the amount of pure carbon now in the earth is almost insignificant in comparison with the total in the form of carbonates. Hunt has estimated that if the whole amount of carbon now in the earth were liberated in the form of carbon di-oxide, the gas would equal in weight two hundred times the present atmosphere. The question naturally arises, whence this vast amount of gas? In considering this question Hunt says: "We are thus forced to one of two conclusions: either the wholly improbable one that the atmosphere since the appearance of organic life on the earth has been one of nearly pure carbonic di-oxyd, and of such immense extent that the pressure at the surface would have sufficed at ordinary temperatures, for

its liquefaction; or else, the atmosphere being so constituted as to permit vital processes, that carbonic di-oxyd, as fast as removed by chemical action at the earth's surface, was supplied from some extra-terrestrial source. We may, in accordance with this last hypothesis, admit that the atmosphere is not terrestrial but cosmical, and that the air, together with the water surrounding our globe (whether in a liquid or a vaporous state), belongs to a common elastic medium which, extending throughout the interstellary space, is condensed around attracting bodies in amounts proportional to their mass and temperature, etc." If this view be correct, it would follow that the diffusion of gases would maintain a certain equilibrium between the atmospheres of different centers of attraction throughout space. This view was first advanced by Sir William R. Grove, in 1842, renewed in 1866, and mentioned by many others since. According to this theory our moon should have an atmosphere; but astronomers have failed to detect it. There can be no doubt that carbon di-oxide was much more plentiful in the air in early times than it now is. The wonderful growth of vegetation can only be accounted for in this way. It is also the most probable cause of the warm temperature of early times. Tyndall very beautifully showed that a small addition of this gas to the air would greatly elevate the temperature by preventing the radiation of heat from the earth, just as the "cold frame" does which the gardener uses in early spring. But to return from this digression. As before stated, the action of the acid liquid on the primitive crust would furnish abundant material for sedimentary deposits. Feldspars disintegrated furnish clays. Almost any silicate that would be affected by acid, would furnish sediments. The crust was probably a mechanical mixture to a great extent, so that quantities of it which were unaffected by the acids, were left in a finely divided state. It is difficult to conceive of the waters under such conditions as being at rest. The tossing ocean that was just being formed would have been an ample vehicle for these sediments, so that deposits could have been formed before dry land emerged. We may look mostly to the air and water for causes of the various phenomena since dry land appeared. That organic matter, resulting from both animal and vegetable life, has also played an important part in geological phenomena is now well known.

The ocean waters would hold in solution great quantities of soluble salts, particularly chlorides of sodium, calcium and magnesium, and sulphates of sodium and magnesium. Rain water washes from the air large quantities of carbon di-oxide, free oxygen, some ammonia, also organic impurities which have been reduced to a finely divided state and are held in the air. By coming in contact with decomposing vegetation the water becomes charged with organic matter which soon combines with the free oxygen, forming thereby more carbon di-oxide. This changes the water from an oxidizing to a reducing agent. Sulphides owe their existence to this fact. Some sulphates are reduced directly to sulphides by giving up their oxygen to carbonaceous matter held in solution. Others are reduced in such a manner that sulphydric acid is generated. This being very soluble in water may be carried by it to different places. It is thus brought in con-

tact with metallic salts which are precipitated as sulphides. It is thought that all sulphides owe their origin, directly or indirectly, to the reducing power of organic matter. Water also takes up from decaying vegetation much soluble earthy matter. Carbon di-oxide gives it the property of dissolving limestone and dolomite which it then holds in solution in the form of bi-carbonates. The porosity of rocks permits the water to gradually sink beneath the surface, so that portions of it come in contact with rock and minerals far beneath. The following figures, showing the amount of water by volume and by weight that 100 parts of different rocks will hold, are taken from a table prepared by Hunt:

	Volume.	Weight.
Sandstone—Potsdam, hard and white	1.39	0.50
Sandstone—Potsdam, with lingula	9.35	3.96
Sandstone—Medina, red argillaceous	10.06	4.04
Limestone—Trenton, gray crystalline	1.70	0.65
Limestone—Trenton, black, compacted	0.30	0.11
Dolomite—Niagara, gray, crystalline	5.27	2.08
Dolomite—Chazy, argillaceous	13.55	5.55
Dolomite— ———, calciferous	7.22	2.27
Limestone—Tertiary (Caen, France.)	29.49	15.85

Feldspathic rocks, especially soda feldspars, are disintegrated by these waters charged with carbon di-oxide, yielding sodium carbonate and clay. The economy of nature is here nicely illustrated by the fact that the soil takes from the water the salts of potassium and ammonium, which are so necessary for plant life, while it gives sodium in return. Thus the waters that are continually entering the ocean, seas and lakes, contain almost no potassium, but large amounts of sodium in the form of carbonate. In early geologic times, when the air contained much more carbon di-oxide than now, and the earth much more albite and oligoclase—soda feldspars—these actions were probably much more rapid. The first reaction between the sodium carbonate and the salts of the sea water would result in converting the calcium chloride into calcium carbonate, (*limestone*), sodium chloride, (*common salt*), being formed at the same time. This, perhaps, was the origin of nearly all the calcium carbonate the ocean water ever contained. In lakes and inland seas where it would be possible to thus decompose all the calcium chloride, the next action would be the conversion of magnesium chloride into magnesium carbonate, with the further formation of sodium chloride. Much of the calcium would be in the form of bi-carbonate, which would react on any magnesium sulphate present, making calcium sulphate, or gypsum, and magnesium carbonate. In these inland seas, where evaporation was continually going on, the gypsum would soon be deposited. Should the concentration be continued, magnesium carbonate would be thrown down along with great quantities of limestone. If such inland seas could occasionally receive an influx of salt water, as many such seas do at the present day, the precipitations would be repeated. If the concentrations should ever be carried far enough salt would

also be thrown down. The salt lagoons along the Black Sea, and other similar places, are instances in which the actions above described are to-day carried on before our eyes. It has been proved by actual experiment, that these actions follow such conditions, so that this is no fine-spun theory. It has also been shown that when a solution of calcium sulphate is surrounded by an atmosphere of carbon di-oxide a much less degree of concentration will precipitate the gypsum. This would help to account for the large beds of gypsum found in some places. Some fresh waters contain calcium sulphate and magnesium carbonate which are deposited by evaporation. Also, many waters containing magnesium and calcium sulphates are mixed with river waters containing sodium carbonate, which changes these salts to carbonates, after which they are much more easily deposited than when held in solution by sea water. This, perhaps, is the origin of many magesium limestones and dolomites, which are not associated with gypsum or common salt.

We may safely conclude, then, that the alternate deposits of gypsum, magnesium carbonate and common salt indicate the former existence of inland seas, which have been subject to a considerable concentration. The continued leaching from the soil of so much sodium carbonate, which is afterwards carried to the sea, can only result in making the sea water more salty, and in a corresponding removal of calcium chloride. That such a change is actually taking place, is proved by comparing analyses of ancient and modern sea waters. In the cavities of many rocks may be found water that was enclosed when the rocks were formed. Such waters contain much more calcium chloride than do our modern waters, but much less sodium chloride.

It does not seem possible that all, or nearly all, limestone is organic, as is commonly taught. There are but two ways by which the great amount of calcium carbonate formed in past time—and which is still being formed—can be removed from the water; first, by precipitation and crystallization; second, by being assimilated by organic life. I cannot help believing that the greater part of it has been precipitated. Large proportions of all limestone, no matter how fossiliferous it may be, has once been in a finely divided state. To attribute the origin of these to disintegrated organic remains, is striving too hard for an explanation.

The western part of Kansas abounds in thick beds of limestone and in chalk formations. This limestone is of a fine texture, gradually grading into the chalk beds. In many places are found almost the entire skeletons of fishes, birds and reptiles of different kinds; also in many places ammonites, which are beautifully preserved. These skeletons are sometimes found with almost all their bones in their proper places. Even a large piece of a saurian skin was found, which must have been left quiet for a long time, or it could not have been so perfectly preserved. In short, there is no lack of evidence that the seas of western Kansas were unusually quiet. Yet, these great beds of limestone have been mostly made up of finely divided calcium carbonate. I cannot conceive of a raging and

tossing sea, necessary to grind to powder such vast quantities of shells, without scattering the bones of the fishes, birds and reptiles more than has been done, without leaving indications of wear on the ammonite shells, or without even shaking from its bed that piece of putrefying saurian skin.

In the early days of geological science, almost every one believed that all crystalline rocks and minerals were of igneous origin. In the course of time another school arose, teaching that all crystalline rocks were of sedimentary origin. These are known respectively as the plutonian and neptunian schools. Modern investigations have brought so much support to the neptunists that the leading geologists of to-day hold with them that crystalline rocks are of sedimentary origin. Many deposits originally contained all the elements found in crystalline rocks; many others, long after they were formed, may have had new elements added by infiltrating waters. The degree of porosity, as before shown, is sufficient to permit such to be done. Internal heat is also an important factor in metamorphic changes. The average rise of temperature as we descend below the surface is one degree F. for about sixty feet. In earlier times, when the outside crust was comparatively thin, this increase was much greater. As deposits increased in thickness the isothermal horizons would rise so that the time would come when they would be heated to a high temperature. The conditions would then be favorable for numerous changes in the sediments themselves. Waters containing alkaline carbonates under heat and pressure will soften almost any silicate. Daubrée has shown that the temperature need not exceed 700° F. for quartz, feldspar and pyroxine to be softened sufficiently to assume the crystalline form upon cooling, and also that at this temperature alkaline silicates in solution will unite with clay to form feldspar and mica. He also showed that the alkali springs of Plombières, with a temperature of 160° F., had acted on the bricks and cement of the old Roman baths so as to form zeolites and other silicated minerals. Different geologists, notably, Mr. Sorby, from their study of crystals, have concluded that granitic and trachytic rocks have been formed in the presence of a liquid under great pressure and at a temperature not exceeding that of redness. These semi-fluid masses, under such great pressure as they probably endured, might frequently be forced into crevices and faults in the rocks above them, and thus present the appearance of igenous rocks.

The question of the origin of volcanoes is one intimately connected with metamorphic changes. The old idea that the lava comes from the molten interior of the earth has many facts in its favor. The greatest of these is the vast extent of simultaneous volcanic action in former times. According to Dana, at the close of the Triassico-Jurassic period, an eruption was continuous from Nova Scotia to South Carolina; the lava throughout the whole extent being doloritic. Much more extensive eruptions have taken place on the Pacific slope. If I rightly understand Dana he thinks that these vast eruptions originated in the molten interior. However, he says, that if such be true, it does not follow that all lavas come from the same source.

In opposition to the theory that lavas come from the liquid interior, is a theory supported by many geologists who suppose that the seat of volcanoes is in the deeply buried sediments. The process of metamorphism, which I have attempted to describe, would doubtless generate great quantities of gases. Much of the salt of the sea water contained in the sediments would give up its chlorine to form chlorhydric acid, which is a gas. Large portions of water would be vaporized. Carbon di-oxide would also be given off from many carbonates. These gases would be held by the superimposed strata until the pressure became so great that they would force their way out through fissures in the rocks, forming trap dikes, or through true volcanoes. It is only reasonable to conclude that in so doing they would force great quantities of the liquid sediments before them.

There are many facts which support this theory of volcanoes.

1. The usual escape during eruptions of carbon di-oxide, of chlorhydric and sulphydric acids, all in the form of gases.

2. The fact that the lavas of different volcanoes vary so much in composition; also that the lavas from the same crater vary greatly at different eruptions.

3. Some lavas contain hydrous compounds which, according to the theory of the cooling globe, could not exist in the original molten interior.

4. The theory demands the extensive generation of gases in sediments, while they are comparatively new. As soon as the deposits were thick enough to raise the isothermal horizon, action would begin. In the course of time a sort of chemical stability would be formed, gases would cease to be evolved, and the cause of eruptions would be removed. The facts correspond to this. The Appalachian system, which is the oldest on the continent, has long been free from volcanoes. The much more recently formed Pacific ranges still have a few, while the Oceanic Islands, around which sediments are now being formed, are the scenes of frequent eruptions.

I am inclined to think that this last theory is the proper one to account for all modern volcanoes. Its causes are surely adequate to the effect.

Some idea of the force of gases under pressure may be formed from the numerous examples in the Pennsylvania oil regions, where water was forced to a great height by that means. It is reported that from one well the water and oil were forced to a height of 180 feet. It probably reached from 125 to 150 feet. But this came from a very short distance below the surface in comparison with the thickness of sedimentary deposits.

In early geologic times, when the crust of the earth was much thinner, and the contraction from cooling much more rapid than now, eruptions from the interior would be no great wonder. But at the present time the liquid mass, if existing at all, must be very far beneath the surface. Hopkins has calculated that the minimum distance to the molten interior must be fully 800 miles. Hennessy assigns 600 miles for the maximum thickness of the crust. However this may be, it is very doubtful if anything from beneath the sedimentary deposits is brought up by modern volcanoes.

The second theory described above does not attribute the heat acquired entirely to chemical action. In fact, this, in many cases, is of such a nature as to absorb heat rather than generate it. Such would be the decomposition of chlorides, sulphates and carbonates by silica. It looks to the great heat in the interior of the earth as one of the important causes.

It has long been known that there is an intimate relation between earthquakes and volcanoes. Earthquakes are a series of terrestrial vibrations which extend from a center as sound waves widen from the place where the air is first set in motion. Now, when the great quantities of gases, which are held under pressure, break through the opening in the rocks, or force new openings if none already exist, great vibrations must follow. This might frequently happen without the escape of gas at the surface, the passage being from one interior cavity to another.

It is counted a sign of an earthquake for an active volcano to cease its flow of lava. This, I think, simply means that whenever the lava stops flowing, something has obstructed the passage of gas from its great reservoir to its outlet, and, before long, pressure becomes so great that it breaks through in the same or in another place.

THE HISTORY OF TIN.

From an interesting paper by E. Reyer, in the Austrian *Zeitschrift für Berg-und Hüttenwesen* (Vol. xxviii., 1880) we gather the following particulars concerning the history of tin. The most ancient names for this metal (Indian, *naga ;* Persian, *aonya ;* Hebrew, *anak ;* Ethiopian, *naak*) indicate that its earliest source was Farther India, from the greater placer deposits of which it was distributed over Asia and eastern Africa. The Mediterranean name, *kassiteros*, used by HOMER, was probably spread by the Phœnicians through their commercial world; and its prevalence from 1000 B. C. indicates the supply of tin through these enterprising traders from Spain and also from Britain. Perhaps they carried the name, though not the article, even to India. At least, it is certain that, in the centuries just preceding the Christian era, tbe name *kastira* occurs for tin in Indian documents, instead of the more ancient native term.

The bronze manufacture of China, which flourished as early as 1800 B. C., and the equally ancient industry of India, must have required large quantities of tin from the Indian placers.

During the commercial supremacy of the Phœnicians, Cadiz in Spain was the principal metropolis. After the Roman conquest of Spain, the British tin trade took a new route. Cæsar speaks of the *plumbum album* of Britain; and DIODORUS relates that it was found as ore in the rocks, and that the smelted metal was carried in bars to Iktis (the Isle of Wight), thence to Gaul, and through Gaul on horses to the Rhone. Marseilles was the shipping port, and soon assumed for this trade the position formerly held by Cadiz.

At this time, the pure metal was used for tinning copper (at which Pliny says the Gauls were very skillful), for making vessels, and occasionally for coin. Its alloys with copper (bronzes) were cast into statues, arms, coins, and mirrors. Probably these alloys were produced, not by mixing the metals, but by the smelting of ore-mixtures containing both metals.

That Cornwall was, during the first centuries of our era, the chief source of tin, is shown by the new name, *stannum*, which replaced *plumbum album*, and which is a Latinized form of the Cornish *stean*, no doubt related to the German *zinn*, and the English *tin*.

After the fall of the Roman empire, other cities took this trade from Marseilles. Thus Cologne, subsequent to the Norman conquest, maintained a direct commerce with England; and in the twelfth and thirteenth centuries, Brügge controlled the whole West-European market, including that of tin. It was here that the Italian and German merchants made their purchases.

After the fourteenth century, the Mediterranean cities obtained a large share of the trade, sending their ships on the one hand to Britain, and on the other to Constantinople and Alexandria. Up to this time, the product of Devon and Cornwall ruled the market. Down to the thirteenth century, the "stream-tin" of Devon furnished much the larger portion; but the mines of Cornwall at last took the lead, and the placer-product of Devon became, and has remained, insignificant.

The royalties paid in Cornwall were at first excessive. About A. D. 1300, the sovereign received 40 per cent of the gross product; in 1480, the tax was 20 per cent to the sovereign and 20 per cent to the landlord; in 1600, the crown abated its claim to 10 per cent; in 1750, the percentages were respectively 6 and 10 to 12; in 1830, 4 to 5 per cent for the sovereign and 5 to 7 for the landlord was the rule; and since 1838, the former royalty has been entirely abolished.

It was in the thirteenth century that the Bohemian mines became largely productive; and during the fourteenth, they probably drove the British tin from the German market.

The manufacture and wide-spread religious use of bells, during the middle ages, is proof of a large consumption of tin. At the end of the middle ages, the introduction and increasing use of bronze cannon demanded still greater quantities of this metal. In the sixteenth century, other important ores were discovered: tin-foil for mirrors, tin-glaze for pottery, etc., and tin-enamel for metallic wares.

In the seventeenth century, Drebbel discovered the value of tin-salts in dyeing. A vessel containing extract of cochineal stood in his window. The window-panes were framed in tin. By accident, a little *aqua regia* was spattered upon the window, and a few drops fell from the tin into the cochineal extract, where they produced a bright red color. The acute chemist did not rest until he had discovered the cause of the phenomenon, and added almost a new art to civilization.

Among the disastrous effects of the Thirty Years' War—perhaps the most devastating calamity of modern times—was the almost total destruction, for at

least half a century, of the mining industry of Germany. The tin mines of Saxony and Bohemia shared in this prostration ; but the ill wind that blew nobody any good on the continent transported prosperity to the shores of Albion. German miners were imported into England, and carried with them their knowledge of hoisting, timbering, draining, drilling, dressing, and smelting. Yet at that period the product of Cornwall was but 1000 tons of tin annually—not one tenth as great as that of the Asiatic mines.

In the eighteenth century, the tin industry of Bohemia and Saxony reached its climax. During the present, it has dwindled away. It was after the middle of the eighteenth century that Newcomen's "fire-engine," and in the "seventies" of that century that Watt's steam-engine was introduced in the Cornish mines. At the end of the century, the product of Cornwall had become 3000 tons annually.

During the first half of the present century, it was noticed that, with increased depth in the Cornish mines, the proportion of copper was increased, and that of tin diminished. This fact will indeed be found laid down in some books as a "law," at least for Cornwall, analogous to that other "law," concerning the decrease of gold in depth, which has been deduced from limited data by hasty philosophers. But since 1850 it has been found that, with still farther advance in depth, the proportion of tin has again become dominant. The "law" is simply one of alternation ; and the product of tin, which has risen to more than 8000 tons per annum, is due to the courageous persistence of men who did not accept mere dogma as truth.

Since the above was written, we have received a pamphlet by Mr. Reyer (Zinn : *eine geologisch-montanistisch-historische Monografie.* Berlin, G. Reimer, 1881; pp. 248, 8vo), which deals with the subject much more fully, giving an admirable *résumé* of the geological, mineralogical, and metallurgical conditions, as well as the history of the different tin-producing regions, and a valuable catalogue of the publications which treat of different branches of the inquiry. From this pamphlet we take the following summary of production in metric tons :

	England.	Straits.	Banca and Billiton.	Australia.	Tasmania.
1870	10,200	4,000	7,500	Little	....
1871	11,300	8,000	7,500	Little	....
1872	9,600	10,000	8,000	1,000	....
1873	10,000	7,000	8,000	6,500	....
1874	9,900	8,000	9,000	11,000	Little
1875	9,500	11,000	9,000	13,500	Little
1876	8,500	10,000	8,000	12,000	3,000
1877	9,500	10,000	7,000	13,000	5,000
1878	10,000	?	?	?	8,000

The great new modern sources of tin are Australia and Tasmania. China is believed to have produced, a few years ago, at least 5,000 tons per annum ; but the Chinese importation at present of some 10,000 tons every year of the cheap wash-tin of India seems to indicate a falling off in the domestic product.

The present annual product of the world is therefore about 50,000 tons It is principally used in Asia for the tinning of copper, and in Europe and America for the tinning of iron. The manufacture of alloys is believed to consume a minor portion only.—*Eng. and Mining Journal.*

THE GAMGEE PERPETUAL MOTION.

BY B. F. ISHERWOOD, CHIEF ENGINEER NAVAL DEPARTMENT.

[Chief Engineer Isherwood recently made a report to the Secretary of the Navy on the Gamgee perpetual motion, from which we make the following extract. The invention will finally, of course, rest on its actual merits :]—Ed.

From observations made by Professor Gamgee in the experimental working of this machine, he deduced the possibility of what he terms a zeromotor, in which, by means of properly adapted apparatus invented by himself, the heat in water or other objects at ordinary atmospheric temperature may be utilized to vaporize liquid ammonia under very considerable pressures, but within the control of known means of retention. The high pressure gas thus obtained being used with the greatest practicable measure of expansion on a working piston generates power, becoming by that very expansive use greatly refrigerated and diminished in bulk, and partially liquefied at the end of the stroke of the piston, when it is exhausted and then returned by a method invented by Professor Gamgee, to the ammonia boiler whence it came. The cycle is thus a closed one ; no material is lost, and no heat is rejected in matter leaving the engine. The work done by the engine is due to the difference in bulk of the material when it enters and when it leaves the boiler, that difference being caused by the heat derived from water or other natural objects in the ammonia boiler and from the refrigeration resulting from the transmutation of a portion of this heat by the engine into the mechanical work performed by the latter. That this difference of bulk exists is indisputable, and if the proper mechanism can be contrived to utilize it, the idea of the zeromotor becomes realized. It will be observed that this power has not been obtained from artificial heat produced by the combustion of fuels, but from the heat of natural objects at ordinary atmospheric temperatures, and therefore costing nothing in money. This is made possible by the fact that liquid ammonia gasifies under considerable pressure at ordinary atmospheric temperatures, the sole difficulty in constructing the zeromotor being to find the means of economically condensing the gas after it has been used on a piston. Were it not for the refrigeration due to the expansive working of the gas, the condensation would have to be obtained by the application, externally to the condenser, of artificially produced cold, and the zeromotor could not be made a commercial success. It is only by obtaining the lower limit of temperature from the action of the engine itself, while the higher limit is furnished without money cost by natural objects at atmospheric temperatures, that commercial success becomes possible.

The purpose of the Department in ordering an examination of Professor Gamgee's ice making machine was not to obtain an opinion on its ice making merits, but one as to whether his observations on the behavior of ammonia in the process were sufficiently accurate to warrant his inference of the practicability of constructing a successful zeromotor for industrial uses—a motor, in short, destined to supersede the steam engine. Accordingly I have closely investigated the working of the apparatus. The facts of liquid ammonia gasifying at ordinary atmospheric temperature under very high pressures, and of that gas undergoing very great refrigeration when used expansively in doing work, are not called in question by any one. Both are well known phenomena. The special fact to be observed was whether any part of the ammonia which entered the cylinder as a gas left it as a liquid, and, so far as the form of the apparatus allowed any observation to be made, such appeared to be the case. The possibility of the invention of a new motor of incalculable utility would seem to be established, and in view of the immense importance of the subject to the Navy and to mankind at large, I strongly recommend it to the serious attention of the Department, suggesting further that whatever facilities the Department can, in its opinion, consistently extend, be allowed to Professor Gamgee for the continuance of his important experimental inquiries in the Washington Navy Yard. He is most anxious to bring his invention, with the least possible delay, to a crucial test by the completion of the necessary mechanism, and its submission to any board of experts which may be ordered experimentally to ascertain its merits. For this purpose he proposes to use such parts of his present ice making machine as can be re-combined in his zeromotor, adding the other necessary parts, and thus producing, with but little loss of time, an embodiment of his idea that will by simple trial show whether an unquestionably correct theory has been successfully reduced to practice.

Professor Gamgee has perfected the calculations and drawings for the mechanism required to give practical effect to his invention, and there remains only to execute the mechanical work. He proposes to use the steam cylinder of his ice-making machine as the ammonia cylinder of the new motor, the present ammonia condenser, and the present ammonia boiler as a low pressure boiler, adding another ammonia boiler as a high pressure boiler. These, together with the ejector between the condenser and the low pressure boiler, a small pump for pumping liquid ammonia from the low pressure to the high pressure boiler, etc., will constitute the zeromotor—a machine, as will be apparent from this brief description, of the simplest, cheapest, and most manageable kind.

In the high pressure boiler the liquid ammonia will be gasified by the heat in water of atmospheric temperature to the pressure normal to that temperature. In the low pressure boiler ammonia is kept at a considerably less tension than in the high pressure boiler, and with this lower pressure ammonia gas the engine is operated, the gas being used as expansively as practicable and made to do work during its expansion, thereby becoming refrigerated, greatly reduced in bulk, and partly liquefied. Immediately on being exhausted the cooled and shrunken

gas, and whatever liquid of condensation may be mingled with it, are discharged by the ejector from the condenser into the low pressure boiler, the ejector being worked by the higher pressure into the high pressure boiler. As a result the low pressure boiler is continually receiving ammonia and heat from the high pressure boiler. This excess of ammonia in the liquid form is pumped by an ordinary pump from the low pressure back to the high pressure boiler, while the excess of heat is continuously being converted into the mechanical work done by the engine. There is also the extinction of such part of the heat in the high pressure ammonia gas working the ejector as is due to the work done by it in forcing the contents of the condenser into the low pressure boiler. Of course the cylinder, heat condenser, the low pressure boiler, and their connections are protected from receiving heat from the atmosphere and surrounding objects by a non-conducting substance.

The plan proposed is far from chimerical. It is based on well demonstrated thermodynamical principles. The whole is definite and precise, both in theory and mechanical detail, nor can it be shown, *a priori*, that there is not a fair prospect for success. There can be no doubt that the product of the pressure and volume of the contents of the condenser which are to be forced into the low pressure boiler, is less than the product of the pressure and volume of the ammonia gas which leaves that boiler to operate the engine, and that this difference which has not been produced by the external application of artificial cold, but by the working of the machine itself, is available for the production of power for industrial purposes. All that remains is to give the system a practical test in order to ascertain whether the mechanism proposed will act efficiently enough to realize the expected result. Should this prove to be the case, the steam engine will, within the near future, be certainly superseded by the zeromotor, for the great item of coal, whose cost is the principal expense of operating the former, will be wholly eliminated with the latter. If it can once be practically shown that a very much cheaper, lighter, and a far less bulky mechanism than the steam engine, including for the latter its boilers, and, in case of steam vessels, the coal bunker and its contents, can be employed for the production of power to any amount without the use of fuel, nothing can prevent its introduction into general use for all industrial purposes, with the vast result of a great cheapening to mankind of every article of manufacture, from the daily bread of the poor to the luxurious textures which robe the rich. The whole world is concerned in the solution of this problem, and the poorer the person the greater is his interest in it. The source of heat for the steam engine is the continually diminishing supply of coal—a diminution that will be severely felt some centuries hence; but the source of heat for the zeromotor is as inexhaustible as the sun himself, and will last undiminished as long as he shines.

The success of the zeromotor is of more importance to the Navy of the United States than to the navies of the great maritime powers of Europe with which it may come in collision, because those powers have colonies and coaling

stations on the farthest shores, while the United States possesses neither, and would consequently, in naval warfare, be at great disadvantage for want of coal —its navy, as a rule, having to render service within a reasonable distance of its own coasts the sole base of supplies. If coal, however, can be dispensed with, we are at once placed on an equality in this respect, and our cruisers enabled to penetrate the remotest seas as easily as those belonging to countries having possessions there.

The enormous importance of a motor capable of superseding the steam engine and furnishing power without the combustion of coal can be estimated from the fact that it would produce an industrial and consequently social and political revolution equal to what was effected by the introduction of the steam engine. The whole of modern society is based on the steam engine which mainly has made the difference between the ancient and the present world, for our civilization would be impossible without it. It is the inanimate slave which performs the labor of mankind, freeing them from the greater part of their drudgery and giving them the time and means for culture.

I have ventured these few remarks to show the nature and scope of Prof. Gamgee's invention, which is not that of a machine for the application of power, but for the immensely more important purpose of generating power itself, so that, strictly speaking, it includes as a basis all other machines. I have wished to show this in order to make clear how different is his invention from those of others who may ask to have their apparatus tested in a Navy Yard, and to bespeak for it the most favorable consideration of the Department.

Professor Gamgee and able assistants—among whom is Mr. W. E. Sudlow, an accomplished mechanical engineer, thoroughly versed in the the theory and practice of his profession — are well acquainted with the difficulties to be overcome. They are quite aware of all the objections that can be raised, and have well considered the means of obviating them. The subject has been carefully studied, and there are brought to bear upon it the requisite scientific and engineering information necessary to give it an exhaustive treatment. His engine, like the steam engine, is a heat engine, and produces power by the conversion of heat into mechanical work, the same quantity of work consuming in both cases the same quantity of heat, but with this immense practical difference, that the heat for his zeromotor is freely furnished to hand by nature, while for the steam engine it has to be excavated from the depth of earth and afterward handled and transported by expensive manual labor.

What is now mainly desired is that Professor Gamgee may be permitted to prosecute his experiments at the Washington Navy Yard to a conclusion, and there bring his engine to a practical test with as little delay as possible. Should the Department be able to grant this, the favor will be well and properly bestowed in the interest of the Navy and of the world. —*Scientific American.*

ARCHÆOLOGY.

PREHISTORIC MAN IN AMERICA.

BY PROF. EDWARD S. MORSE.

No subject in recent times has developed a larger or more active class of workers, or can lay claim to a more voluminous series of publications, than that pertaining to prehistoric man. Every nation working in science has added to its contributors, and these contributors have generally been drawn from a class already trained in methods of scientfic search.

So rapid has been the growth of the study of prehistoric man, that every student recalls its infancy and its advance to a vigorous science. He remembers the dread experienced at the thought of impeaching the clearly defined record of Genesis, and he recalls with impatience how long it was before the evidence which had been gathering for a century could command a hearing. Collections had been slowly accumulating, though lying dormant and dusty on museum shelves, and their records, unpublished, suddenly came into notice, and with a prodigality of material and data in numberless hands, the elements were ready out of which rose the new science of archæology.

So fully imbued were men's minds with the idea of the recent and historical origin of the human race, that no possible interest could be excited in what purported to be the evidences of a preadamite people. In vain did archæologists offer their evidences of the high antiquity of man. Their discoveries were treated with incredulity, and their arguments rejected as worthless. A memoir read by Mr. Vivian before the Geological Society of London was considered too improbable for publication. The massive authority of Cuvier, who denied the possibility of man's existence anterior to those animals which live to-day, prevented the acceptance of Dr. Schmerling's remarkable discoveries in the Belgium caves.

Unquestioned acceptance of the Mosaic cosmogony has not only prevented the earlier development of this science, but it has caused the loss of a mass of evidence which can never be restored. Discoveries have been suppressed, false interpretations have been put upon others, valuable material has been ignored or lost, and in one way and another the study of man's early existence has been thwarted up to very recent years.

The sudden and wonderful growth of the study of man's high antiquity has been wholly due, not to the evidences—for these had been despairingly thrust before the learned societies to be again and again rejected—but to the rapid acceptance of those rational views which recognize man's origin from the animals before him.

Once it came to be fully believed that man was a mammal in the sense that systematists had recognized him to be, but a species of mammal among hundreds of other mammals, who, with them, had some common ancestry, and the study of archæology assumed the rank of an inductive science. A short time has seen the formation of imposing societies, many of them highly endowed; of magnificent museums, devoted exclusively to the preservation and exhibition of objects pertaining to this science; the publication of anthropological journals and transactions, and, above all, the production of a large number of illustrated works, which bring the science to the comprehension of the general reader.

It is quite necessary to understand all this to comprehend the amazing growth of a study which should have interested the race centuries ago. At the outset, the term prehistoric man was looked upon as applying to a people who lived before the dawn of recorded history—a people who lived, not in any hypothetical Eden, but among other places, in the valleys of France and the caves of Belgium and England.

So limited was his area, and so apparently similar were all his characteristics, that for a time no further subdivision was necessary. A few years ago, comparatively speaking, his high antiquity and wide distribution over the face of the earth was not dreamed of. No account was taken of any possible geological changes having occurred since his appearance. It was enough to assert, with more or less positiveness, that his remains were synchronous with those of a few extinct species of mammals. That the contours of the land and ocean boundaries were essentially the same for prehistoric man as for his historic descendants, could not for a moment be doubted. That during man's early reign the English Channel and Irish Sea had no existence, and an uninterrupted sweep of forest extended from the regions of Paris and London and across and beyond Ireland, far out to the present one-hundred-fathom line, no one dreamed of conceiving.

In the light of this knowledge, it is instructive to quote Dr. Wilson's words in his "Prehistoric Annals of Scotland." In reference to the Scottish aboriginal traces he says: "There is one certain point in this inquiry into primitive arts which the British antiquary possesses over all others, and from which he can start without fear of error. From our insular position it is unquestionable that the first colonist of the British Isles must have been able to construct some kind of a boat and have possessed sufficient knowledge of navigation to steer his course through the open sea." Such were the positive and emphatic utterances of a writer who, in his recent valuable work on prehistoric man, in referring to this very passage confesses that this was no certain postulate after all, and who recognizes the profound geological changes which have taken place since paleolithic man first chipped the rude stone celts whose imperishable characters give us our only clue to his existence.

The hypothesis of geological changes of any magnitude being excluded, it was impossible at that time to grasp the true import of rude chipped flints deeply buried in river gravel. Just as soon as the early remains could be looked upon

as veritable fossils—the name sounded so ancient—to be studied in precisely the same way, and with the application of the same methods of reasoning as were brought to bear upon the remains of a paleotherium from the tertiary, or upon an ammonite from the Jura, then, and not till then, could his high antiquity be realized. And not until rude stone implements from the river-gravels and similar deposits were brought to light in France, Portugal, Germany, Brazil, India, New Jersey, and other widely separated countries, was the inconceivably long duration of man upon the earth acknowledged. The recognition of these evidences has been, and is at this time, hampered and retarded by a rigid and almost ridiculous scrutiny of every object bearing upon this subject. The study of other fossil mammals goes on unimpeded. Professors Marsh and Cope collect their fossils and assign them to their proper geological horizons unchallenged save by the hostile Indian. The archæologist, on the contrary, has (for his best good it must be confessed) standing over him one set of critics, generally theological, who deny his facts, or call his evidences spurious. He is belabored by another set, generally theological also, who claim for man peculiarities which separate him from all considerations which would apply to other mammals below him. By another set still, who, ignoring the doctrine of probabilities, are ready to call every skull, or other remains showing quadrumanous features, abnormal or pathological. Thus, the ape-like skull of the Neanderthal cave was looked upon as a synostotic cranium. The extreme improbability that, in these frequently occurring and widely distributed cases, only idiotic or abnormal forms should come to light, never seems to trouble these critics.

While the general acceptance of the theory of man's origin from the lower animals has induced the present activity in archæological research, it is equally true that the study has contributed valuable evidence to the general correctness of Darwin's views.

The divisions of the tertiary, though artificial, are recognized by the varying percentages of the species of mollusks which are now extinct. If we are fortunate enough to get the remains of the very early man—not his works, but his bones—we shall, in the same way, estimate his degree of savagery and bestial features, and, possibly, his age, by the proportion of those characters which are not only outgrown by man at the present day, but which bring the widely diverging lines of man and the apes a little closer.

Now, as we have to do with the remains of man, not in the beds of the tertiary, where superposition is well established, but with his remains found in modified drift, river-gravels, and other rocks, whose age and synchronism are so difficult to establish, it would seem that here the trained osteologist must take up the investigation.

The recognized sequence of rude stone implements, polished implements, bronze, and iron, while holding good for limited areas, becomes of less value for larger fields when it is known that tribes with rude stone implements are existing to-day. A few hundred years ago the European combatted with gunpowder the inhabitants of a vast continent who belonged to the neolithic age.

It is assumed by archæologists of great repute that since, in Europe, pleistocene deposits have yielded only the rudest of worked stone, therefore in no deposits older than the pleistocene can we expect to find evidences of a more primitive workmanship. This postulate may be admitted in regard to certain parts of Europe, for nothing more primitive than the rude celts can be imagined. Before this time, man, in that region at least, must have used natural fragments of stone and sticks, and even the faculty to use these indicates an advance far above his progenitors, who had not yet acquired this faculty.

It is again assumed that since man is the most highly specialized mammal, it is not conceived that he could have lived in the upper and middle tertiaries, because, of a large number of mammals living at that time, the species, and lower down the genera and families, are extinct; and, therefore, man, so far above these in organization, must have come in at a later date. On the other hand, it does not seem improbable that the single living species of man may be the sole survivor of a number of fossil species, and even genera, now extinct. Such a condition of things would find its parallel in many, if not in all, of the living species of mammals to day who represent the survivors of a line of species and genera far back in the tertiary.

In regard to the other assumption—that man is the most highly specialized mammal—we think even this is open to suggestive doubt. In that he possesses a highly convoluted brain, with all its capabilities and possibilities as we find him to-day, he certianly is highly specialized; but as a mammal—and only as a mammal must we regard him—he belongs to a more generalized type. If we consider him only in relation to those mammals nearest related to him, we find all his characters held by no one ape, and to find his resemblances one has to consult a variety of forms. His structural relations are found in the gorrilla, chimpanzee, orang, gibbon, *Simiadœ*, and even in the half apes, the lemuroids. It is true that most of his resemblances are with the higher apes, but these are not of sufficient weight to assure us that any of them are his progenitors. Indeed, if we care to credit such high authorities as Mortillet, Dr. Hamy, and others, man existed in the middle miocene associated with the first anthropoid ape, *Dryopithicus*, and in later beds still with *Oreopithicus*, which, according to Gervais, had affinities with the anthropoid apes, macaques, and baboons.

Professor Cope, in considering man's relations to the tertiary mammals, says that "the mammals of the lower eocene exhibit a greater percentage of types that walk on the sole of their feet, while the successive periods exhibit an increasing number of those that walk on their toes, while the hoofed animals and carnivora of recent times nearly all have the heel high in the air, the principal exceptions being the elephant and bear families." He then goes on to show the successive osteological changes of the foot from the earlier types to the later ones, through several lines of descent, and says: "The relation of man to this history is highly interesting. Thus in all generalized points, his limbs are those of a primitive type so common in the eocene. He is plantigrade; has five toes; separate

tarsals and carpals; short heel; flat astragalus, and neither hoofs nor claws, but something between the two; the bones of the forearm and leg are not so unequal as in the higher types, and remain entirely distinct from each other, and the ankle joint is not so perfect as in many of them. In his teeth his character is throughly primitive. . . . His structural superiority consists solely in the complexity and size of the brain. A very important lesson is derived from these and kindred facts. The monkeys were anticipated in the greater fields of the world's activity by more powerful rivals. The ancestors of the ungulates held the fields and the swamps, and the carnivora, driven by hunger, learned the arts and cruelties of the chase. The weaker ancestors of the quadrumana possessed neither speed nor weapons of offense or defense, and nothing but an arboreal life was left them, when they developed the prehensile powers of the feet. Their digestive system unspecialized, their food various, their life the price of ceaseless vigilance, no wonder that their inquisitiveness and wakefulness were stimulated and develoed, which is the condition of progressive intelligence;" and adding that "the race has not been to the swift, nor the battle to the strong," Professor Cope shows in this case that the "survival of the most intelligent, and natural selection proves to be, in the highest animal phase, intelligent selection."

Mr. Fiske shows, in another way, that when variations in intelligence became more important than variations in physical structure, they were seized upon, to the relative exclusion of the latter.

The earliest evidences of man must be sought for in his remains, for he must have existed in much the same condition many ages before the use of rude stone implements gave him any advantage in the struggle for life. These evidences have never been found. When man acquired the habit of seeking the shelter of of caverns, or the custom of burying in sepulchers, then it became possible to preserve his remains for future generations to study; but outside of these fortunate receptacles, his remains have been rareley met with. The probable habits of primitive man and his progenitors were of such a character as to render the preservation of his remains one of extreme improbability.

The herbivora, roaming in immense herds, fording streams, and seeking shelter from the flies and heat in watery places, where, if they died, all the conditions for the preservation of their remains might be expected; the amphibious mammals becoming well preserved in the matrix in which they perished; the colossal mammals becoming mired by their own weight; all these various conditions were favorable for the preservation of those remains which are found in the greatest abundance.

The arboreal ancestors of man, on the other hand, left their remains strewn on the forest-floor, or weathering in rude tree-nest, the most uncertain of all places for their final preservation.

Professor Marsh, in his magnificent monograph on the extinct fossil toothed birds of North America, testifies that fossil birds are of the rarest occurrence, and to their arboreal habits may be due their rarity; the remains of aquatic birds being always more common.

Even if early man and his progenitors sought shelter in caverns, Professor Dawkins, the distinguished British archæologist, shows that while there have probably been caverns in all geological periods, they have all been obliterated by "the rain, the alternation of heat and cold, the acids evolved from decaying vegetation, and the breakers on the sea shore," and this obliteration has been so thoroughly accomplished that there are only two caverns known that can be said to be as old as the middle pliocene.

Without entering into any discussion regarding the submergence of the coast line in many parts of the world, and its subsequent erosion, thus removing traces of ancient people who have sought the sea for food, we may accept the evidences offered to show that paleolithic man came from the south, for he makes his appearance along the southern borders of the northern ice-sheet.

It is a significant fact that, with the appearance of the glacial fields, the later tertiary apes were driven out of Europe, never to return, whilst paleolithic man came in, and was able to endure the very influences that caused the disappearance of the apes. This shows how vast a change had taken place at that early time between man and his anthropoid relatives.

He came from the south, from those regions where the least exploration has been carried on, and where the difficulties are generally greatest for such explorations. It is also in the equatorial regions that we have the hypothetical Lemuria, Atlantis, and other submerged areas, which were generally supposed to have been lands teeming with life.

An argument for believing that he lived in the earlier tertiaries may be found in the fact that his characters, as seen in the earliest remains, are yet promptly recognized as human. It is true they depart somewhat from the characters which distinguish the race to-day, nevertheless the race, with its wide variation, can compass, without violence, the most aberrant form yet found. It is man that is recognized, and not ape, and that man could have lived through such long ages with so little change is an argument that his progenitors must have lived long anterior to the earliest traces yet found.

If we consider the minor subdivisions of man in time since the neolithic age, we can trace some of his incursions. We can, as it were, see him coming from some unknown quarter, and frequenting regions never before inhabited by him.

(*To be continued.*)

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, April 23.

The earthquake at "Chio's rocky isle" has resulted in the death of 12,000 individuals. The catastrophe is dreadful. However, in the Caraccas in 1812, more than 20,000 persons perished. The first Lisbon earthquake, in 1531, destroyed 30,000 persons, and that of 1755, 50,000, not counting its recoil in Morocco, where 12,000 inhabitants perished. The "shock" extended even to Scotland, as such travel at the rate of 470 to 530 feet per second. From 1785 to 1857, the then Kingdom of Naples lost 111,000 inhabitants. As for the victims in Peru, earthquakes appear to be a matter of course in that region. Respecting the catastrophe at Chio, which occurred on the 3d of April last, the first shock took place at forty minutes past one, and lasted eight minutes. Few houses resisted; twenty minutes later a second, and then a third shock ensued which destroyed the few houses that at first escaped. The shock had a kind of spinning movement, in the direction east-west, and changed the sites of buildings by six to eight inches. The cracks in the ruined dwellings commenced from below, eastward, terminating always at the top, westward. The only minaret in Chio that escaped was that built in cut stone; all constructions in masonery were overthrown without exception. Not only the kind of building materials employed, but the nature of the building site, has much to do with the resistance. The shock traveled very rapidly over the gneiss and mica-schist rocks, and was next to stopped in the plains. Along soil of a volcanic origin the shock was very intense; on the contrary in the case of alluvial soils, it was next to insensible. The gravity of the Chio catastrophe is due to the fact that the soil is of eruptive origin. When the earthquake took place the sea was as smooth as glass, the sky overcast, the atmosphere heavy, the wind southerly—the precursors certain of an earthquake. M. Fouque is of opinion that the disaster at Chio is to be attributed to a sinking of the soil. M. Lacau thinks the contrary; hence, there is nothing certain. The volcanic axis or line does not positively traverse the island, so that it is possible internal erasions having taken place, the superincumbent rocks, simply in their profound depths, fell in, producing the convulsion; thus there would be no connection with such a result and a seismic origin. The transformation of a portion of the Island of Reunion three years ago is owing to such a cause. In any case the moral of the Chio calamity is this: abstain from occupying isles of a volcanic origin, as being devoid of stability, and if occupied, erect only structures of a special order, and as widely separated as possible.

The trichina causes less anxiety. No person has been affected by the malady,

and though America be accused of importing the disease, the United States never made larger consignments of ham and pork to France than at present. It was an unsettled point as to whether or not the worm existed in the fat—its natural home being the muscle. M. Chatin, after devoting much attention to the solution of the question, has finished by discerning it in the fat of bacon.

Some months ago four laborers, employed to look after the city sewers, descended by the trap door into a main situated on the Boulevard de Rochechouart. Fifteen minutes later they were brought up suffocated. Inquiry demonstrated that they were victims of the reprehensible practice of the drivers of the night-soil carts, emptying the liquid stuff into the sewers—an act severely prohibited. It was alleged by the Night Soil Company that death could not have resulted from such a cause, admitting even that the carters had been guilty. The authorities directed Messrs. Boutney and Descourt to investigate the matter. They have just made known the result. The night soil liquid disengages poisonous gases, even when disinfected with sulphate of copper They placed Guinea pigs in a cage and submitted them to the gases emanating from a night-soil reservoir. The animals died within a period of five seconds and three minutes. The experiment was repeated on a large dog. After two minutes it fell on its side; another minute and it expired. The capacity of the cage in which the Guinea pigs were enclosed was 3½ gallons. One quart of liquid was poured inside; the animals expired in five seconds. So much for the unpurified liquid. That disinfected invariably produced death in the space of five minutes. Chemical analysis demonstrated that the toxical gases disengaged were sulphuretted hydrogen and sulphhydrate of ammonia; that the non-disinfected liquid, when shaken, gave off per quart 140 per cent of sulphuretted hydrogen, and the disinfected 40. Further experiments showed that the 200th part of that hydrogen in the air sufficed to suffocate animals; that a cubic yard of the non-purified and the same quantity of disinfected liquid poisoned respectively twenty-eight and eight cubic yards of air so as to render its respiration mortal.

In France it is an old woman's remedy to conduct children suffering from whooping cough to breathe the air in the refining chamber of a gas factory. The inspiration of the gas was never known to do good, and Dr. Poincaré now asserts that after numerous experiments on animals, he found that their lungs had been profoundly altered by breathing coal gas; that granulations were produced.

In the cavern of Lherm, in the department of the Ariege, paleontologists draw their supplies of bones of carnivorous animals that sought refuge there during pre-historic times. Bears' heads are very plentiful, and M. Filhol has presented specimens quite different from any race of bears hitherto known. He also concludes the white polar bear has come southward and accommodated its habits to the life of other bears. The same cave in question has yielded the fossilized femur of a lion, 18 inches long—proof that the animal must have been of an enormous size.

M. Reyrusson has discovered an azoteous ether, not only a perfect disinfectant, but an antiseptic at the same time, the only agent filling the two roles effectively. Its preparation is, however, costly. Messrs. Girard and Pabstdisinfect night-soil reservoirs by dissolving lead crystals in sulphuric acid, when azoteous acid, a very active agent in acidation, is eliminated. M. Sulliot has tried to disinfect sick chambers with the Girard and Pabst process, but the fumes of the disengaged acid are rather too irritating for the patients. It is an excellent agent in the case of cess-pools, and so is employed in the Hospital la Pitie, in that end, where the night-soil reservoirs are so vast. The gases eliminated from the latter are collected in a chimney filled with coke and wet with sulpho-nitric acid.

Paper, like wine, seems to be made out of every matter. Wood is largely employed, and when mixed with a little rag, becomes more tenacious. It is the cellulose matter of the fibre that is utilized. Messrs. Deung & Co. have made a rapid stride to solve the pressing question of finding a substitute for paper, and have succeeded with cow and horse excrements, by submitting them to the action of sulphuric acid. The animals, however, must be fed on a strictly cellulose diet, grass, hay, etc.. Beautiful white paper has thus been manufactured, and the residue can be employed to produce ammonia, aniline, epuchsine, etc.

Closely connected with this subject is the production of sugar, also from cellulose matters, whether these be old shirts or saw dust. By submitting such substances to the action of sulphuric acid, which thus converts them into dextrine, the latter, after being placed in a solution of lime, is again operated upon by sulphuric acid, that converts it into syrup or glucose, which, though not crystalized, is not the less sugar, and is extensively employed in the preparation of jams, jellies and bon-bons. In France wood, as in Germany, is being tried for the preparation of sugar, and one manufactory turns out large quantities of glucose by operating on starch, which is also a cellulose body.

For tinning sauce-pans about 5 per cent of lead is added. When this percentage is exceeded, toxical results may be anticipated M. Maistrasse indicates a means for the detection of the excess, or to ascertain if the tin be pure. Wash the surface with muriatic acid, or diluted in water. If a characteristic black results, the proportion of lead has been exceeded. Pure tin leaves no such black stain.

There are many means for inducing sleep. Drowsy syrups are chiefly resorted to, and also sub-cutaneous injections of morphine. Preparations of bromine are also employed, and chloral is an important agent. Dr. Bisenz, of Vienna, has a cheaper remedy than any. He maintains all that is necessary is an indulgence in forty winks, almost. He literally recommends to open and shut the eye lids thirty times in succession. This induces such a fatigue of the muscles that the patient falls unconsciously asleep. It is said that it is quite a common place remedy in Persia. In that country there is also a cheap and effective way for

curing hiccups. Cause the sufferer to hold his arms above his head for a few minutes. Startle him with some sensational news, specially imagined, and the inconvenience will be the more speedily laid.

The Touaregs tribes, occupying the South of Algeria, have breeds of sheep and asses remarkable for their immense size, only the former have hair instead of wool. A society is in process of formation to acclimatise many European animals in Algeria, and to work up the natural products of that country. It is thus that sponge is being exported of late, though it be not of such a superior quality as that from the Grecian Archipelago. Attention will also be directed to the rearing of bees, of which the rich flora of the colony and its mild climate present superior advantages.

Two volumes worth reading, "Les Infininent petits," by Felix Heinent, and the "Curability and Treatment of Pulmonary Consumption," by Dr. Jaccoud. The Doctor dissipates many obscure points, and his work is written in so seductive a style as to cease to have the air of a medical treatise. M. Jaccoud is the author of that profound remark, "The treatment of the phthisical is only a long meditation upon death."

METEOROLOGY.

SOMETHING ABOUT TORNADOES.

BY S. A. MAXWELL, MORRISON, ILL.

In studying the charts contained in the reports of the Chief Signal Officer, I discovered a number of facts relative to tornadoes, which, so far as I know, have never yet appeared in print. One of these is the fact that these meteors almost invariably occur on the south side of the line of minimum barometric pressure. I have said *almost* invariably, because my investigations are yet quite limited—having extended but little outside the year 1878. During the period included in the investigation, there does not occur a single exception to the rule, as the facts herein stated will show.

Areas of low barometer or storm areas, generally move across the United States in an easterly direction; and the storms accompanying take very nearly the same course. It has been determined that the greater quantity of rainfall takes place in the front half of the area of low pressure. This is evidently due to the fact that warm winds prevail in this portion; and these as they approach the storm-center rise to the region of "upper clouds," where their moisture is condensed, and precipitation is the result. Now the following facts will show

that the tornadoes noted by the United States Signal Service Corps, during the year 1878, occurred in that half of the storm area lying toward the equator.

An area of low pressure, originating in the Pacific Ocean, west of Oregon, passed southeast over the Rocky Mountains and onward to central Texas, thence to the northeast, finally leaving the United States at Cape Cod. The storm-center was at Memphis, Tennessee, on the 7th of February, 1878, and on that day destructive tornadoes occurred in Richmond county, Georgia, and during the forenoon of the next day at Augusta, Georgia, and at Fayetteville, North Carolina. These localities were from 300 to 400 miles south of the track of minimum pressure.

The next tornadoes of the year occurred on May 23rd, at Mineral Point, Wisconsin, at Barrington, near Chicago, and at Quincy, Illinois. In this instance the center of low pressure is traced from British America, just north of the Montana line, (May 22nd,) eastward to the Gulf of St. Lawrence, which it reached on the 27th. The storm center reached the meridian of Mineral Point early on the morning after the tornado. In this case, as in the others, the tornado was 400 miles south of the path of minimum pressure, and at the time of its occurrence, was 600 miles southeast of the storm-center. The storms at Barrington and Quincy were near the outer borders of the storm-area, and probably for that reason were much less destructive than the terrible cyclone which devastated southern Wisconsin.

Tornadoes occurred at Gardiner, Illinois, and at Davenport, Iowa, on May 31st. The storm-center was in southern Kansas on the morning of that date, and in northwestern Iowa in the evening. Note the similarities of this with the preceding.

A storm-center, originating in northern Colorado on the morning of June 1st, passed northeast, leaving the continent north of the Gulf of St. Lawrence. At about three o'clock p. m. of the day named, a tornado occurred at Richmond, Mo.; at which time the storm-center was at Grand Island, Nebraska. This was quite a destructive storm—over a hundred buildings being destroyed at Richmond and thirteen persons killed. By turning to the map of the United States, one can see how clearly this storm resembled that at Mineral Point in relative positions of storm-center, and locality of tornado. About an hour after the Richmond tornado, another took place on the Platte river near Clarke's Station, Nebraska, and what is worthy of notice, within twenty miles of the storm-center, but still to the southeast of it.

A storm-center, originating on the evening of June 8th, in northwest Kansas, moved east, reaching Cape May in just 48 hours. At 4:30 p. m., on the 9th, it had reached the extreme northeast corner of Kentucky. A tornado occurred in Richmond county, Georgia, on this date—the hour not given in the Chief Signal Officer's Report. Assuming that it occurred at 4:30 p. m.—the hour of their most frequent occurrence, we find the storm-center about 400 miles northwest, as in a number of instances previously cited.

A storm-center was in Canada, just north of Lake Champlain at 1:20 p. m.

of July 21st; a tornado occurred in eastern New York, 200 miles nearly due south, at the same hour.

A tornado did considerable damage in Washington county, New York, on the 26th of the same month. It belonged to a storm-area, whose center passed near Rochester at the hour the tornado occurred, viz.: 5:30 p. m. In this case the locality of the tornado was somewhat farther north than the storm-center, but yet on that side of its path *toward* the equator.

The destructive tornado occurring at Wallingford, Connecticut, August 9th, belonged to a storm-area, whose center never entered the United States, being first reported from near Vancouver's Island, whence it moved almost due east, leaving the continent at the Gulf of St. Lawrence. At 6:00 p. m. of the 9th, it had reached a point about fifty miles north of Quebec. At this hour the Wallingford cyclone occurred. In this instance the tornado happened about 400 miles south of the line of "low," and somewhat in the rear of the storm-center.

The last tornado, recorded for 1878, destroyed Sherman City, Isabella county, Michigan, on the 20th of September. The track of minimum pressure was traced from Dakota, eastward over the northern part of Lake Huron, thence through northern Canada, in a line nearly parallel with the river St. Lawrence. It will be noticed that the tornado occurred to the south of this track, but at no great distance from it. As in the case of the Wallingford storm, the center of the low pressure had passed the meridian of the locality where the tornado was developed.

In this list of storms, I have not included one that did not bear the distinct features of a tornado. In newspaper phraseology the term tornado is applied indiscriminately to severe storms of wind, accompanied by rain; but, strictly speaking, it applies only to such as are distinguished by a rotary motion, precisely like that of an ordinary whirlwind. In my researches on this subject, I have found that a large majority of the destructive storms of 1878, occurred in the south half of the storm-area; and I think that further investigation will prove that nearly one-half of all the destructive storms are developed in that quarter of the storm-area which is in the anterior half, and at the right of the path of minimum pressure.

Let us recapitulate. Of the ten genuine tornadoes of 1878, just *one-half* happened in May and June; all but one or two, in the afternoon; *seven* were in advance and *three* in the rear of the storm-center, at distances varying from 20 to 600 miles from it; and *all were on the equatorial side of the path of minimum pressure.*

In this article I have made a brief statement of a few facts, inaccessible, perhaps, to a majority of the readers of the REVIEW, from which material all who desire may rear the fabric of their individual conclusions. Only from an accurate statement of facts can we build tenable theories or deduce the laws of science.

Morrison, Ill., April 30.

THE PASSING OF "LOW" BAROMETER.

BY ISAAC P. NOYES, WASHINGTON, D. C.

"Low," it may be proper to say, is the short and technical term for low barometer, and that the passing of "low" refers to the movement of this condition over the country.

* * * * * * * * *

The storm center, *low*, is the governing point, the "passing of *low*" over the country is the agent of the storm. Back of this, of course, is the concentration of the sun's rays, which produces, over the world's surface, points or localities of rarification of air which are continually on the move—we think, ever and ever around the world. We cannot prove this at present for want of stations, yet we have the best reasons to believe that such is the fact.

When one becomes familiar with the laws governing the weather, especially with that which is positive and not merely speculative knowledge, it is very absurd to hear people even suggest such an idea, that there must be some other laws unknown to those who knew the most, and essentially all there is as to the general laws governing the matter, and that some ignorant person with great pretentions knows more, especially so when his ignorance is manifest in all that he says. But, says the common sense of the world, has he not produced results, and are not results the thing after all? What matters science and full and complete knowledge if some half-witted fellow can, every time, do better than the wise and scientific? *Results* are what the practical world demands. Well, *we* want results, and we think it very absurd for a man to pretend to know so much about the weather, and not be able to tell for one locality as well as for another, to be able to tell fair weather as well as great "eleven-foot snow storms," etc.

We challenge him, or his friends, to produce any results beyond those which any other guesser of the weather can produce.

To those who know nothing of the law of periods, which storms follow, and their causes, it seems very strange to see a man say that it will, according to the time of year, snow, rain, thunder or blow *somewhere* over the vast territory of the United States on the 2d or 4th, 7th or 8th, 11th or 12th, etc. Yet to the person who knows these laws, it is no more strange than if A knows that B is about sure to be within or in the neighborhood of a certain large area every four days on an average, for A to put on a wise look and say B will be there on such and such days of the month. But, after all, there is no satisfaction in such a statement, for many others know the whereabouts of B even better than A, but neither A nor all the others who have this knowledge know *just* where B is going to strike, how he will strike, what will be the result, and whether he will move over one section or another, or produce a certain effect every time.

Then, if this "weather prophet" who has created such a sensation has reliable knowledge, and can figure it out months in advance, does it not seem absurd in him simply at first to make a general statement covering what everybody

knows is the most probable thing to expect, for example, that "March will come in like a lion, and go out like a lamb," etc. Does it not seem absurd for him not to give the detail knowledge at the time he gives the general knowledge that everybody knows as much about as he?

But there is method in this plan of *general knowledge first, and detail knowledge after a while*, say about the middle of each preceding month.

Through the month of March and up to the 16th of April, the storm centers passed this meridian at very regular intervals, but then came a change, and the four days interval, which had been so regular, was broken.

The way to accomplish this, is general prophecy first, and detail prophecy after awhile. The method of it is first to publish, for the different months of the year, such weather as may be expected to occur. Then for details, about the middle of the month preceeding, note how the storms are running.

As often stated in these papers, a storm passes over the territory of the United States once in about three or four days—four days is a fair average. About the middle of the month, say as in February, this year, figure out the month ahead on this basis: If the season has been rather cold, predict snow, cold winds, etc. About the middle of February, this year, it would figure out for the meridian of Washington, the 3d to 4th, 7th to 8th, 11th to 12th, 16th to 17th, etc. This basis for a four days' interval, especially for the month of April, till after the 16th, was very regular, for the meridian of Washington, the 1st, 4th, 8th, 12th and 16th, but after the 16th the interval of four days was broken, and another storm appeared here on the 18th. But predictions on this basis, after all, do not, and did not, amount to any practical value; the storms were not all alike, and did not pass over the same lines—there was no resemblance to each other beyond being storms. They did not originate in the same place, nor follow similar tracks, excepting the general easterly direction of all storms; some came from the extreme southwest, others from a little higher line, while still others came from high up in the northwest, each taking tracks peculiar to itself and producing unlike results. As a rule, however, they all passed this meridian more or less south of Washington, after which they took a northeast course toward the northern part of New England and Eastern Canada; and this was the general course which the majority of storm centers, *low*, took through the greater part of the winter, and the reason why it remained so cold throughout the greater portion of the United States, the reason why we had no January thaw, and why it was relatively, at least, warmer way up in Maine than throughout the more southern country, and why this spring they have had such terrible floods out west. Had *low* traveled on a high line of latitude during the mid-winter months, we would have had the usual thaw, and streams would have been relieved by degrees.

As before often stated, the "passing of *low*" is the regulator in these matters. If *low* passes on a high line, it will be relatively warm, if on a low line, cold, if on a medium line, neither cold nor warm. If on a high line, it will create southerly winds; on a low line, northerly winds; if on a medium line the north winds will not go far south, the southerly winds not far north. There will

be a compromise, as it were, between the north winds and the south winds, the result of which will be a medium temperature.

These statements are not mere theories nor ideal conceptions, but substantial facts, which can no more be disproved than that water will run down hill, or that combustion will produce heat.

But what about that snow storm in Chicago on the morning of the 19th of March, when Mr. Vennor said that about the 20th of March or thereabout, there would be a great snow storm in the "lake region," and that, too, said some weeks in advance, when on the very morning of the 19th of March, the weather bureau said that the indications for this region were for fair weather.

At first it certainly appears that the weather prophet was at least right *that time*, and that the weather bureau, to say the least, committed a most awkward blunder. But before we commit ourselves, let us weigh well the facts in the case, and consider well the causes which produced the snow storm.

In the first place, the Signal Office takes three observations daily—at 7 a.m., 3 and 11 p. m.

An average speed of *low* is about three hundred and fifty to four hundred miles in twenty-four hours. When the storm center *low* is at St. Louis on one day, on an average, on the morning of the second day thereafter it will be at Washington.

There is, however, no regularity about the speed of *low*, for sometimes it will even go from the base of the Rocky Mountains to the Atlantic coast in twenty-four hours. But these instances of great speed are exceptions. I only mention this irregularity of speed to show that there is no knowing before hand, at least at present, the rate at which it will travel. As little can we know in advance the direction it will take. And this illustrates one of the greatest difficulties with which the signal office has to contend. They see a storm in the west. What time will it reach the meridian of Washington? If they give out an "indication," it must be founded upon the *average* and *not upon the exceptional* speed. Again, if a *low* is in the west, what course will it take? This is fully as important as the speed. It may keep on a straight line and follow a line of latitude in its course, or trend more or less to the north as it advances east.

On the morning of the 18th of March, low was in the extreme southern portion of Texas, with the center even still further to the west, or southwest, but owing to the want of stations in this region we cannot tell exactly where the *center* was, but we do know that it was somewhere beyond Brownsville.

The morning reports for the press must be made up at midnight—to accommodate all parts of the country, one will see that the reports could not be much later.

At 11 o'clock on the night of the 18th of March, *low* had advanced up into Mississippi.

These southwestern *lows* had, prior to this, traveled within certain lines, or probably better, traveled within a certain arc. They had either gone straight across the country, passing off the land on the Florida coast, or in their passage

trended more or less to the northeast, extending to an arc of forty-five degrees, and not taking a direction more north than this. The one preceding this of the 18th, was picked up in Texas, at a higher line of latitude, yet it did not sweep a curve higher than Washington, and then took a slight downward course, and passed off the coast in the neighborhood of North Carolina. From all past experience, it was expected that this *low* would reach a higher line than Washington, or that it would reach this locality before the 20th, and probably not until the 21st; and little was it expected that it would go in the direction of Chicago. But instead of doing what its predecessors had done, what was naturally supposed it would do, it, instead, took an unprecedented course from where it was at 11 o'clock on the night of the 18th, and went with unprecedented speed almost due north!

For the day of the 19th of March the indications for the "lower lake" region were "fair weather, westerly wind, becoming variable; stationary or lower temperature, nearly stationary barometer."

By the time the indications were in press, the *outer lines* of the storm had reached Chicago, and presented a strange contrast with them.

In order to have brought that snow storm to Chicago on the morning of the 19th, *low*, at the least calculation, must have traveled fully a thousand miles in twenty-four hours, and that, too, in a direction as remarkable, if not more so, than the speed. Had *low* moved only at the rate of 350 or 400 miles in twenty-four hours, when it reached Chicago, it would have brought so much warm air with it that it would have produced a very warm rain, instead, as it did, a severe snow storm. With the map in the like condition of March 18th, the chances are that the same indications would be given to the country every time, and ninety-nine times out of a hundred they would have been fulfilled.

With those ignorant of the weather system, the passing of this *low* was very detrimental to the signal office, and brought great honor to the "weather prophet" of Canada.

Here are the facts of the case, and no white-washed or dressed-up facts are they, for such facts as these cannot be covered or made to appear in any other light than that in which they appear and are recorded. With this knowledge there are only two lights in which to see Mr. Vennor, the "great Canadian weather prophet." He is either ignorant of the whole weather system, or has allowed himself to be unjustly praised, and that, too, when this praise has carried with it the severest censure upon a worthy and honorable institution, and more, upon worthy, able, honest and earnest men, who are trying to make our weather bureau the most complete of the world, and who are laboring industriously for the advancement of true science; and even carried with it a slur upon Americans as a people, and America as a nation. And yet in this contest, a contest worthy of the interest of the wisest, where do the intelligent people of the country stand —even scientific men? Why, they fold their hands, refuse to investigate the weather system, even at the paltry cost of two cents a day, and join with the rabble, who know no better, and actually condemn their peers without the trouble to in-

vestigate the causes and facts in the case. They can thank or blame themselves. The opportunity to learn has been presented to them. For a number of years the weather map has been submitted to them, but they have paid about as much attention to it as they would to the croaking of the frogs in the pond.

The great difficulty with the world is that, through various causes too numerous and intricate to enlarge upon here, it is inclined to seek explanation for scientific phenomena through that which is in itself unexplainable, weird, mysterious and far-fetched rather than through the channels of plain matter of fact. For example, hardly a week passes but that some gifted writer, some person holding a high position in the world, and acknowledged even as high scientific authority, insists and persists upon connecting the weather of our globe with the moon, the stars, the icebergs, electricity, etc., and particularly just now with the stars. Because certain planets happen at this time to be nearly in a line with the sun, they become quite eloquent over what they imagine to be the effects produced by it. Though they can prove nothing by this system, and while all can be proved and sustained by the facts connected with the weather map, they still persist in ignoring the plain facts before them, and seek explanation in that which is as idle as the tales of old Sir John Mandeville about the geography, physical and ethnological science of his day. Instead of having faith in such spirits as Columbus, Raleigh and the Cabots, in men who seek to discover facts in regard to the world, they prefer, like old Sir John Mandeville, to "go to Alexandria," and there accept all the idle stories of those who know no more about the facts than themselves, and then deal them out to their neighbors as truth, while they let the real facts of the case remain undisturbed, and unaided allow the spirits of Columbus, Raleigh and the Cabots to wrestle, poorly provided and single-handed, with the storms of unknown seas. They flatter themselves that their way is the best and the only way, and, therefore, they continue to remain in ignorance of the true facts. It is not to be wondered at that they are so ready to condemn such an institution as our weather bureau, and to extend such praise and sympathy to such "weather prophets" as are trying to take advantage of their ignorance. The weather bureau can well afford to "abide its time."

To come back to the Chicago snow storm, if Mr. Vennor is ignorant of the causes which produced the storm there on the 19th of March, he is to be pitied, on the other hand, if he knows enough of the weather system of our globe to be able to understand these causes, he is wanting in a high sense of right, in remaining silent in regard to it. Were he familiar with the causes, he has had ample time ere this to have published a note in the papers in regard to it; but as he has not done so, up to the time, (April 30th, '81,) the most charitable light in which to view him, is as ignorant of the laws of meteorology—ignorant in the very department in which he endeavors to excel. By the world at large, this Chicago snow storm was his climax of honor; as the world advances in intelligence in this direction, it will prove an avalanche that will bury his reputation as a meteorologist out of sight for all time, unless he learns as he lives, and, with the increase of knowl-

edge, comes forward and does what an honorable man would do under the circumstances—acknowledge that there are things in meteorology which he had not, up to that time, dreamed of.

I have here suggested meteorological clubs—I would not have them expensive institutions. I would have the people of America take hold of this subject in a wise, common sense American way.

I will repeat that I do not speak *ex cathedra* for the weather bureau. I simply here speak in the interest of science, enlightenment, and right. I believe it to be for the best interests of all good and wise American citizens—indeed the citizens of the whole world—to be familiar with this question, at least as familiar as they are with natural philosophy, geography and the arts.

Let the people of the country understand the *Passing of Low*, be able to comprehend its meaning and the technical meaning of *High and Low*, and the weather bureau will no longer be the insignificant and almost contemptible thing that it is. It will not have to go a begging for a mere existence. Its friends and patrons will spring up in every township, and hosts of friends will be glad to do it service, fight its battles and protect its honor.

A careful daily study of the weather maps—noting the movement of storms --how an area of *low* is picked up in the West, on a high or low line of latitude—how it travels eastward—the line, the course and spread it takes—how rapidly it moves at one time, how slow at another—how it varies with the seasons—how it readjusts temperature—how it generally works to the north as the sun rises in the ecliptic, and how high a line it reaches at times even when the sun is along the lower line of the ecliptic—how January thaws are produced—the cause of the peculiar weather which makes the seasons; the severe cold of winter, the warm spells of mid-winter, the cold spells of mid-summer—the high winds of February and March, the warm spells of May and Jnne, the hot and dry spells of July and August—the cause of that peculiar condition of weather which we term "Indian Summer," the climax of the year when Nature, especially here in America, appears in her most resplendent colors, when the harvest-moon is in all his glory and the fruits of the year are being gathered for the benefit and comfort of man and beast through the long winter. To be able to understand such things—to know how to account for them. It would seem that such knowledge was well worthy the interest of the wisest, instead of being their contempt or indifference.

The world little dreams of the interest centered in these maps. To neglect them longer, is to remain in willing ignorance, and this, it would seem, was not the part of wise men to do. There is much poetry, as well as good common sense, in the full understanding of the *Passing of Low*, to comprehend it is to gain much wisdom on a subject that is full of beauty and of great practical benefit to mankind.

THE DARK DAY IN CANADA.

In some interesting and graphic reminiscences of Montreal sixty years ago, Mr. J. H. Dorwin writes to the Montreal *Star* as follows:

What was the strangest occurrence of that time, or rather the strangest thing that ever happened in the history of this country, was what has been always known as the "Phenomenon of 1819." On the morning of Sunday, November 8, 1819, the sun rose upon a cloudy sky, which assumed, as the light grew upon it, a strange greenish tint, varying in places to an inky blackness. After a short time the whole sky became terribly dark, dense black clouds filling the atmosphere, and there followed a heavy shower of rain, which appeared to be something of the nature of soapsuds, and was found to have deposited after settling a substance in all its qualities resembling soot. Late in the afternoon the sky cleared to its natural aspect, and the day was fine and frosty. On the morning of Tuesday, the 10th, heavy clouds again covered the sky, and changed rapidly from a deep green to a pitchy black, and the sun, when occasionally seen through them, was sometimes of a dark brown or an unearthly yellow color, and again bright orange, and even blood red. The clouds constantly deepened in color and density, and later on a heavy vapor seemed to descend to the earth, and the day became almost as dark as night, the gloom increasing and diminishing most fitfully. At noon lights had to be burned in the court-house, the banks, and public offices of the city. Everybody was more or less alarmed, and many were the conjectures as to the cause of the remarkable occurrence. The more sensible thought that immense woods or prairies were on fire somewhere to the west; others said that a great volcano must have broken out in the Province; still others asserted that our mountain was an extinct crater about to resume operations and to make of the city a second Pompeii; the superstitious quoted an old Indian prophecy that one day the Island of Montreal was to be destroyed by an earthquake, and some even cried that the world was about to come to an end.

About the middle of the afternoon a great body of clouds seemed to rush suddenly over the city, and the darkness became that of night. A pause and hush for a moment or two succeded, and then one of the most glaring flashes of lightning ever beheld flamed over the country, accompanied by a clap of thunder which seemed to shake the city to its foundations. Another pause followed, and then came a light shower of rain of the same soapy and sooty nature as that of two days before. After that it appeared to grow brighter, but an hour later it was as dark as ever. Another rush of clouds came, and another vivid flash of lightning, which was seen to strike the spire of the old French parish church and to play curiously about the large iron cross at its summit before descending to the ground. A moment later came the climax of the day. Every bell in the city suddenly rang out the alarm of fire, and the affrighted citizens rushed out from their houses into the streets and made their way in the gloom toward the church, until Place d'Armes was crowded with people, their nerves all unstrung by the events of the day, gazing at, but scarcely daring to approach the strange sight

before them. The sky above and around was as black as ink, but right in one spot in mid-air above them was the summit of the spire, with the lightning playing about it shining like a sun. Directly the great iron cross, together with the ball at its foot, fell to the ground with a crash, and was shivered to pieces. But the darkest hour is just before dawn. The glow above gradually subsided and died out, and people grew less fearful and returned to their homes, the real night came on, and when next morning dawned everything was bright and clear, and the world was as natural as before. The phenomenon was noticed in a greater or less degree from Quebec to Kingston, and far into the States, but Montreal seemed its center. It has never yet been explained.

METEROLOGICAL REPORT FROM APRIL 20, TO MAY 20, FROM OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA, KAS.

BY PROF. J. T. LOVEWELL.

The period of this report from April 20th to May 20th, has been one of remarkable vegetable growth. There have been showers on fifteen days, but no very heavy rain. The largest rainfall was in a shower on the 18th, when 0.98 inches fell. Four of these storms have been accompanied by lightning and thunder, but there has been little strong wind. The rains have also in great part fallen in the night, and thus in every respect were calculated to accomplish the greatest amount of irrigation of the soil compared with the total rainfall. The promise of fruit and crops in this section, and in most of the State, is at present excellent. To illustrate the advancement of the season it may be observed that wild roses were in bloom here May 12th, and Syringa (P. Coronarius) on the 20th.

The miles traveled by the wind are only about two thirds of that recorded last month.

The highest pressure was 29.28 in. April 29th; the lowest 28.72 in. May 9th; range, 0.56 inches.

The highest temperature was 86° on May 15th; the lowest 48° on May 2d; range, 38°.

The lightest velocity of wind was 38 miles on the 10th, and no calms have been observed.

For the first time in several months, we notice a great prevalence of south winds. The northeast winds have been next in frequency. The humidity has been high, especially in the last two decades.

It can hardly be said now, in spite of the late state of vegetation, that the season is backward.

	Apr. 10th to 20th.	Apr. 20th to 31st.	May 1st to 10th.	Mean.
TEMPERATURE OF THE AIR.				
MIN. AND MAX. AVERAGES.				
Min.	51.9	57.6	60.6	56.7
Max.	75.9	77.6	79.9	77.8
Min. and Max.	63.9	67.6	70.2	67.2
Range.	24.0	20.0	19.3	21.1
TRI-DAILY OBSERVATIONS.				
7 a. m.	56.1	63.0	65.4	61.5
2 p. m.	71.6	73.6	77.1	74.1
9 p. m.	62.1	64.7	69.7	65.5
Mean	63.0	66.1	70.5	66.5
RELATIVE HUMIDITY.				
7 a. m.	.87	.90	.87	.88
2 p. m.	.66	.73	.70	.70
9 p. m.	.70	.88	.83	.80
Mean	.76	.84	.80	.80
PRESSURE AS OBSERVED.				
7 a. m.	29.00	28.94	29.02	28.99
2 p. m.	28.97	28.92	29.00	28.96
9 p. m.	28.97	28.90	29.00	28.62
Mean	28.98	28.92	29.01	28.97
MILES PER HOUR OF WIND.				
7 a. m.	13.9	10.6	10.5	11.6
2 p. m.	17.2	14.1	11.1	14.1
9 p. m.	10.6	13.4	6.2	10.1
Total miles.	3108	2910	2630	8648
CLOUDING BY TENTHS.				
7 a. m.	6.3	7.9	7.1	7.1
2 p. m.	5.9	7.7	5.7	6.4
9 p. m.	4.3	6.0	5.3	5.2
RAIN.				
Inches	.660	1.38	1.58	3.62

HISTORICAL NOTES.

EARLY NOTICES OF THE MISSOURI RIVER AND INDIANS.

BY JOHN P. JONES, KEYTESVILLE, MO.

Probably the first white man to hear of the Missouri river was James Marquette, * the Jesuit missionary, who in the year 1669 was stationed at La Pointe, near the western extremity of Lake Superior.

This mission was visited by wandering bands of Indians from the head waters of the Mississippi and from its branches as far south as the Illinois.

From one of the Illinois Indians, Marquette learned the language of that tribe, and through him and his companions heard of the Missouri.

In a letter written in the year 1670 to Father Francis Le Mercier, the Superior of the Huron missions, after giving him such information as he had gathered con-

*Marquette was born in the province of Champagne, France, in 1637, entered the society of the Jesuits in 1654, sailed for Canada in 1666, was sent to the Ottawa Mission in 1668, and transferred to La Pointe in 1669, from there to Mackinaw in 1670, from which place he started in 1673 on the voyage of exploration down the Mississippi river, returned in September as far as Green Bay, visited the Illinois in 1675, and died on his return on the east shore of Lake Michigan, May 11th, 1665.

cerning the Mississippi river, at this date only known by report, and the Illinois Indians, to whom he was expecting to be sent as a missionary, he says:

"Six or seven days below the Illinois is another great river, on which are prodigious nations, who use wooden canoes. Of these we cannot write more till next year, if God does us the grace to lead us there."

This is the only allusion to the Missouri river that I know of as occurring in the writings of any of the western missionaries prior to the exploration of the Mississippi river.

The Illinois Indians at this time occupied territory on both side of the Mississippi, and the Missouri would be six or seven days below them. The word Missouri means canoe in the Algonquin language, and it should be born in mind that it is the name applied by Indians of that stock to our Indians, who used canoes made out of logs while their own were made of birch bark. Three years later in company with Joliet, * Marquette embarked from Mackinaw on the voyage that resulted in the exploration of the Mississippi river, and in the latter part of June, 1673, passed the mouth of the Missouri. The noble river, gorged with its annual spring rise, seemed as it poured out its mighty volume to contend with the Mississippi for the mastery, and Marquette, in his relation of the voyage, refers to it as follows: "As we were sailing gently down a beautiful still, clear water we heard the noise of a rapid into which we were about to fall; I have seen nothing more frightful; a mass of large trees entire with branches, real floating islands came rushing from the mouth of the river Pehitanoui † so impetuously that we could not without great danger expose ourselves to pass across; the agitation was so great that the water was all muddy and could not get clear. Pehitanoui is a considerable river which coming very far in the northwest empties into the Mississippi. Many towns are ranged along this river, and I hope by its means to make the discovery of the Red or California Sea."‡ The Gulf of California had been called the Red Sea by the Spaniards on account of its fancied resemblance to the Red Sea of Asia. Prior to this voyage of Marquette and Joliet the French authorities had hoped that the Mississippi would be found to empty into the Gulf of California, and by this means give them a passage to the South Sea. Marquette had now proceeded far enough to enable him to conclude that the Mississippi emptied into the Gulf of Mexico, and he, therefore, expressed the hope that the route to the Gulf of California might be found by the way of the Missouri. From 1673 to 1680 the valley of the Missis-

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*Louis Joliet was born in Quebec, in 1645, joined the Jesuits at an early age, and was educated by them, became a free trader, and was noted for his acquaintance with the Indian character and languages, was named by the French authorities in 1672 to explore the Mississippi river. Made a journey to Hudson's Bay in 1679. In 1680 he received a grant of the island of Anticosti, for his services. In 1694 he explored the coast of Labrador, was made royal pilot for the St. Lawrence in 1695, and died about 1700.

†Pehitanoui is the name by which the Indians accompanying Marquette called the Missouri river. The word is probably Algonquin. The Missouri's spoke a dialect of the Dacotah language and their name for the river is unknown.

‡On June 4th, 1672, the French Minister wrote to Talon, then Intnedant of Canada, as follows: "As after the increase of the colony there is nothing more important than the discovery of a passage to the South Sea, his majesty wishes you to give it your attention."

sippi was visited only by occasional trappers and traders who left no written record of their visits. In the latter year there arrived in the Illinois country the real pioneer of the valley, René Robert Cuvelier, better known as La Salle,* which name he took from landed estates belonging to his family, who came with the intention of exploring the Mississippi to its mouth. No man has stamped his name more ineffacaebly on the pages of French-American history than La Salle. He arrived in the Illinois country in the year 1680, after enduring with his party hardship that even now seem appalling to think of, and at once set about preparing for his proposed voyage down the Mississippi. Hennepin,† one of the missionaries accompany ing him, mentions inhis "Description de La Louisanes"—Paris, 1688, the following incident as occurring at one of the Illinois viliages, and which shows that the location of the Missouri Indians was known at that early date to the missionaries and explorers. He says: "Needing Indian corn, La Salle took some and gave in return hatchets, and offered them a treaty for the exchange of those things most necessary to each, such as provisions for hatchets; however, if they would not exchange, he would go to their neighbors, the Osages, treat with them, and also leave with them a smith, who would mend their hatchets and other implements; the smith being of so much importance the Illinois consented." These Indians wishing to retain La Salle and his party with them, endeavored to dissuade them from going down the Mississippi, picturing the perils they would encounter, in such dismal colors, that many of the men were disheartened and it required all the address of their leader to prevent them from deserting in a body. As they continued on down the Illinois they met a portion of the tribe returning from a hunt, who, not knowing what had already been told by those at home, gave an entirely different account of the river below. Of this Hennepin says: "This meeting diminished in a good measure the fears of our men, and they were entirely relieved by the arrival of several Osages, Chickasaws and Arkansas, who came from the south to see the French and buy hatchets." From this it will be seen that our Missouri Indians had discovered the superiority of the French hatchets of iron over their own of stone, as had also the lower tribes who sent delegations with them. La Salle did not perfect his arrangements for the exploration of the Mississippi until February, 1682, at which time he started from the mouth of the Illinois. In the meantime the Iroquois had swept down on the Illinois villages while most of the warriors were absent on a hunt, killing a great

*La Salle was born at Rouen, France, in 1643, entered the society of the Jesuits, but left them and sailed for Canada in 1666. Discovered the Ohio river in 1669. Explored the Mississippi from the mouth of the Illinois to the Gulf of Mexico in 1582. Left France again in July, 1684, in command of an expedition for the mouth of the Mississippi, landed on the coast of Texas, and after making several attempts to reach Canada was assassinated by his own men in March, 1687, near Trinity river, Texas.

†Louis Hennepin was born in Aith, province of Hainault, entered the order of St. Francis, early developed a roving disposition, was made an army chaplain in 1674. Sailed for Canada in 1675, was stationed at Fort Frontenac in 1676. Went to the Illinois country with La Salle, and was sent by him to accompany a part of his command to explore the upper Mississippi, and was captured by the Sioux, was rescued from them in the fall of 1680. Soon after returned to Europe and published an account of his travels in 1683. He finally died in obscurity, though his book had twenty editions, in half a dozen languages, and within a year has been translated and published in this country with extensive notes.

many and scattering the remainder. Upon the return of the warriors from their hunt, the battling was renewed, but the Illinois were finally forced to retire across the Mississippi and seek refuge among the Osages.

Father Membre,* another missionary in La Salle's party, in his narrative of "Discoveries in the Mississippi Valley," published in Le Clercq's "First Establishment of Faith in New France," Paris, 1691, mentions this as follows: "There had been several engagements with equal loss on both sides, and at last, of the seventeen villages, the greater part had retired beyond the river Colbert,† among the Osages, where a part of the Iroquois pursued them." Of La Salle's voyage down the Mississippi, the same writer gives an extended account, and mentions the Missouri as follows: "The floating ice kept us at this place till the 13th of February, when we set out and six leagues lower down found the Osage river coming from the West. It is as full as large as the river Colbert into which it empties, troubling it so that, from the mouth of the Osage the water is hardly drinkable, the Indians assure us that this river is formed by many others and that they ascend it for ten or twelve days to a mountain where it rises, that on the river are a great number of large villages of many different nations, arable and prairie lands, and abundance of cattle and beaver. Although the river is very large, the Colbert does not seem augmented by it, but it pours in so much mud that from its mouth the water of the great river is more like clear mud than river water."

After his return from the mouth of the Mississippi, La Salle conceived the project of establishing a colony of French and Indians at Fort St. Louis,‡ on the Illinois river near the Kaskaskia village. He hoped to embrace in this confederation a majority of the western tribes, and among them the Missouris. Out of the profits of their trade and the furs gathered, he expected to be remunerated for the losses he had sustained in his enterprises and which now amounted to forty thousand crowns. But while he had been contending in the valley against difficulties and obstacles calculated to dishearten the stoutest spirit, a change had been in the government of the province detrimental to his interests. Govenor Frontenac § his friend and supporter had been recalled to France and his place supplied by Le Febre de la Barre, an old naval officer, illy fitted for the station to which he had been promoted. La Salle made an effort to secure his good will and wrote him early in 1683, expressing the hope that he should have from him the same

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*Lenobious Membre, a Franciscian friar, native of Bafaume, France, arrived in Canada in 1675. Stationed at Fort Frontenace in 1678 Accompaied La Salle to the Illinois country and the Gulf of Mexico in 1862. Returned to France and sailed again with La Salle as Superior of Missionaries and landed with the colony in Texas. Was left there when La Salle started on his fatal journey and was killed with his companions at the destruction of Fort St. Louis in 1689.

†Colbert. This name was given to the Mississippi River by Joliet on his return to Canada, in honor of the French Minister of that name and was adopted by the French for a considerable period.

‡Fort St. Louis. La Salle gave this name to the post he established on the Illinois in 1680, it being on the summit of a great rock near the present village of Utica. He also gave the same name to the post he established on the coast of Texas in 1685.

§Louis de Baude, Count of of Pallua and Frontenac, was appointed govenor and arrived in Canada in 1672 was recalled in 1682.

support as from Count Frontenac, although, says he, "my enemies will try to influence you against me." He failed to secure the support of La Barre, but on the contrary, encountered his determined opposition. On the 4th of June, 1683, he wrote him regarding the future of the colony and says, "The Iroquois are again invading the country; they have lately murdered some of the Miami families and they are all in terror again. I am afraid they will take flight and so prevent the Missouris and neighboring tribes from coming to settle at St. Louis as they are about to do." Soon after this, La Salle returned to Canada and from there repaired to France. In 1684 he sailed for the Gulf of Mexico, intending to establish a colony at the mouth of the Mississippi, but by mistake landed on the coast of Texas after losing nearly all his stores. Here he built another Fort St. Louis and made several attempts to reach Canada with a portion of his command, failing, however, and was killed by one of his own men in 1687. Some of his men were successful in making their way to the Illinois country, among them Father Douay,* one of the missionaries in his party. Douay's narrative is published in Le Clercq's work previously mentioned, and in giving an account of their voyage up the Mississippi, he says: "About six leagues above this there is on the northwest, the famous river of the Massourites or Osages, at least as large as the river into which in empties. It is formed by a number of other known river everywhere navigable, and is inhabited by many populous tribes, including the Osages who have seventeen villages on a river of their name which empties into that of the Massouites to which the maps have also extended the name of the Osages. The Arkansas Indians were formerly stationed on the upper part of one these rivers, but the Iroquois drove them out by cruel wars some years ago so that they, with some Osage villages were obliged to drop down and settle on the river which now bears their name." It will be noticeable that the Missouri river is sometimes called the river of the Osages. This custom, I think, prevails mostly in the writings of the missionaries, who accompanied La Salle, and who were of the order of St. Francis, while Marquette was a Jesuit as were the greater part of all the missionaries in the West. La Salle was educated by the Jesuits, but early in his career, parted from them and became mistrustful of their intentions toward himself, so much so, that he avoided any connection with enterprises in which they took part. A jealousy also existed between the missionaries of the different orders, and to this, may be ascribed, perhaps, the use of the word Osage by the Recollects, in writing of our river, which had been called Missouri by the Jesuits. Father Douay says there is not a word of truth in the narrative of Marquett, and Le Clercq in his work, while careful not to mention his name, insinuates that his narrative has no foundation in fact.

After the assassination of La Salle in Texas, the command of the remnant of

*Anastasius Douay. But little can be learned of this priest. His visit to America with La Salle's command is the first positive information we have of him. He returned to France in safety and re-visited America in 1699 with Iberville, after which we have no rceord of him.

his party who were endeavoring to reach the Illinois couutry, fell on Joutel.* His journal was published in London in 1714 and in describing their course up the Mississippi, he says: "We held on the 30th and 31st and the 1st of September passed by the mouth of a river called Missouri whose water is always thick and to which our Indians did nor forget to offer sacrifices." The custom of offering sacrifices in the form of presents, to rapids and other evidences of force in nature, prevailed among several of the Indian tribes in the West. Hennepin mentions that the Sioux made offerings to the Falls of St. Anthony,† of buffalo robes, and other instances might be quoted, but at the mouth of the Missouri, some years before, a party of Miamis pursued by Mitchigamies, had been drowned and since then, Indians, in passing, throw presents into the water, in order to appease the Manitou which they suppose to dwell there. While it seemed the lot of La Salle to antagonize, in many instances, his associates in the enterprises he directed, yet he also inspired strong friendships. Among those conspicuous for devotion to his interests, was Henri de Tonty‡ one of the purest and grandest characters connnected with the exploration of the Mississippi Valley. When La Salle left the Illinois country for France, in 1683, Tonty was left in charge of his interests at Fort St. Louis. He was still there in 1687 when Joutel and his companions reached it, but they concealed from him the knowledge of the death of his commander. After hearing of La Salle's death he started in 1688 from his fort on the Illinois, intending to try and reach the Fort St. Louis on the coast of Texas and relieve the little band of Frenchmen left there by La Salle, if they were yet alive. His party, consisting of only eight persons, succeeded after great hardships, in reaching what is now the northeastern part of Texas, where discouraged, they turned back for the Illinois country. In his Memoirs, published at Paris, 1693, he says: "We arrived on the 17th of October at an Illinois village at the mouth of their river; they had just come from fighting the Osages and lost thirteen men but brought back one hundred and thirty prisoners."

On the 28th of February he arrived at the little village of Caddoquis on Red

*M. Joutel was a native of Rouen, France. He served sixteen years in the French army and on his return to his native town, found it excited over preparations for fitting out La Salle's last expedition. He volunteered and became the chief reliance of La Salle in his many adversities, and finally, on the death of the latter, his stccessor. After leading the remnant of La Salle'ss command who were trying to find the Mississippi, to ths Illinois country, he returned to France and petitioned the king to succor the colony in Texas. Failing of success, he returned to Rouen when Chalevoix visited him thirty years later.

†The principal deity of the Sioux was supposed to dwell under these falls. Jonathan Carver in his travels, etc., mentions that in 1776 he saw an Indian throw everything he had about him into the cataract as an oflering to the deity.

‡Henri de Tonti, an Italian officer and protege of Prince de Conti, who accompanied La Salle from France in 1678. He had lost one hand in the Sicilian wars and wore one of metal in the place of it. He descended the Mississippi in 1682 with La Salle, and on their return, was left at Fort St. Louis as La Salle's representative in the Illisois country, while the latter went to France In 1685 he heard that La Salle had arrived on the coast near the mouth of the Mississippi and at once descended in search of him, but not failing in his search, returned to the Fort. In 1687 he took part with DuShut in Demonville's campaign against the Iroquois. In September, 1688, he heard of La Salle's death and made an unscccessful attempt to relieve that portion of the command left in Texas. Returned to Fort St. Louis in 1689 and remained there for several years, receiving important concessions from the king in 1699 in regard to the Indian trade. He joined Iberville in lower Touisiana in 1702 and led an expidition against the Chickasaws. Nhe date of his death is unknown.

river and from his account of what transpired there it would seem that they were also at war with the Osages. After describing their reception he continues: "The next day a woman who governs this nation came to visit me with the prin-"cipal persons of the village. She wept over me, demanding revenge for the "death of her husband, and of the husband of the woman we were bringing back, "both of whom had been killed by the Osages. To take advantage of everything "I promised that the dead should be avenged." About the year 1690 Tonty petitioned the king of France to be recompensed for his services, accompaning his petition with an account of the route from the Illinois to the gulf of Mexico. In his petition he refers to the Missouri as follows: "The river of the Missouris "comes from the west and after traversing three hundred leagues arrives at a lake "which I believe to be that of the Apaches. The village of the Missourites, Oten-"tee and Osages are near one another and are situated in the prairie one hundred "and fifty leagues from the mouth of the Missouri." The above extract shows that Tonty's information concerning the country watered by the Missouri was derived from heresay and from Indians alone, as no white man had been up the Missouri at that date. It is true Baron La Hontan claimed to have ascended it in 1689 and to have spent eight days on it, but he was so given to exaggeration that I do not feel authorized to repeat what he says in regard to it. In the year 1699 the brothers Iberville and Bienville arrived in the gulf of Mexico and established a French colony near the Mississippi which eventially became the seat of French power in the whole valley. Communication was soon opened with the Illinois country; Tonty went down from Fort St. Louis as soon as he heard of the establishment of the colony and from this date most of our information concerning the Missouri country comes from sources connected with the lower settlements.

In "Penicant's Annals of Louisiana from the first establishment of the colony to 1722," the author says under date of 1700 in describing the route of an expedition to the copper mines in the country of the Sioux, "Six leagues more brought "us to the mouth of the Missouri. This river has a very rapid current especially "in the spring of the year when the waters are high; in passing beyond the islands "which it inundates it roots up the trees, and drags them along in its course, and "it is from this cause that the Mississippi is filled with floating trees. It also as-"sumes its color from this river, neither source of which has ever been discover-"ed, I will not speak of the Indians dwelling on the banks of the Missouri because we have never ascended it."

In the year 1699 St. Cosme,* a missionary priest from Canada, descended the Mississippi and in a letter describing his trip refers to the Missouri as follows: "On the 6th of December we embarked on the Mississippi; after making about "six hundred leagues we found the great river of the Missouris which comes from "the west and which is so muddy that it spoils the waters of the Mississippi which "down to this are clear. It is said that up this river are a great number of Indi-

*John Francis Buison, born in Canada 1667, educated for a Jesuit Priest and ordrined in 1690. Went to Natches as a Jesuit missionary in 1700. Was killed by the Indians in 1707 while descending the Mississippi.

"ans." At another place he mentions a meeting with the Arkansas and says: "We told them we were going further down to their neighbors and friends, that "they would see us often, that they would do well to assemble all together, so as "more easily to resist their enemies. They agreed to all and promised to try and "make the Osages join them, who had left the river of the Missouris and were on "the upper waters of their river." In the year 1700 M. Le Seuer, a Canadian and kinsman of Iberville, was sent to establish a post at the source of the Mississippi and in his narrative of the voyage he refers to the Missouri as follows: "The Sioux generally keep to the prairies between the upper Mississippi and the "river of the Missouris and live solely by hunting." At another place he says: "We ascertained that the Ayavoes and Octoctatas* had gone to station themselves "on the side of the river of the Missouri in the neighborhood of the Maha, a na- "tion dwelling in those quarters." Under the date of 1702 he refers to a meeting he had with some Canadians as follows: "Having gone six leagues and a quar- "ter I halted at the mouth of the Missouri river and met here three Canadian trav- "elers who were coming to join my company. I received by them a letter from "Father Marest, of the Mission of the Immaculate Conception in Illinois, warning "me that the Languetas had been defeated by the Sioux and Ayavoes and had "joined with a part of the Mecoutins,† Foxes and Mitsigamias to avenge them selves, not upon the Sioux, for they fear them too much, possibly upon the Ayavoes, perhaps on the Paonties‡, or more likely upon the Osages, for these mistrust nothing and the others are upon their guard.

Father Gravier, one of the most prominent of the early missionaries of the west, in writing of a voyage that he made down the Mississippi in 1700 says: "The Arkansas river runs northwest; and by ascending it they go to reach the river of the Missouris by making a portage." This portage could be made between the branches of these rivers, but not the main streams. As most of the traveling in those days was made with canoes, it was essential to have a knowledge of the crossings or portages. Father Gabriel Marest, in a letter from Kaskaskia dated Nov. 9th, 1712, says: "Seven leagues below the mouth of the Illinois river is found a large river named Missouri, or more commonly the 'Pektanoni,' that is to say 'muddy water,' which empties into the Mississippi from the west side. It is extremely rapid and soils the beautiful waters of the Mississippi, which run from there to the sea. It comes from the northwest very near the mines which the Spanish have in Mexico, and is very convenient to the French who travel in that country." In another place he says, "We are but thirty leagues from the Missouri or Pektanoni. This is a large river which flows into the Mississippi, and they pretend that it comes from a still greater distance than that river. It is up on the Missouri river that the Spaniards have their best mine."

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*Iowas and Otoes.

†This tribe of Indians early disappeared. They were generally known as the Fire Nation. At the time of the first exploration of the west by the French, their home was west of Lake Michigan, in what would now be the State of Wisconsin.

‡Pah Utah—now Ute.

It will be seen that the Spanish mines in New Mexico were attracting the attention of the Jesuits, who advised their superiors of any and everything that could possible be of interest or benefit to their order. Father Charlevoix, in one of his letters to the Duchess of Les De Guireres,* dated at Kaskaskia, Oct. 20, 1721, has the following relative to the Missouri and Osages. "The Osages, a pretty numerous nation, settled on the side of a river that bears their name and which runs into the Missouri about forty leagues from its junction with the Mississippi, send once or twice a year to dance the calumet amongst the Kaskaskias, and are actually here at present. I have also just now seen a Missouri woman who told me that her nation is the first we meet with going up the Missouri, from which she has the name we have given her for want of knowing her true name. It is situated eighty leagues from the confluence of that river with the Mississippi. This woman has confirmed to me what I heard from the Sioux, that the Missouri rises out of some naked mountains, very high behind which there is a great river which probably rises from them also and which runs to the west. This testimony carries some weight, because of all the Indians we know none travel further than the Missourites." This great river that runs to the west, and of which he heard from the Sioux and Missouris both, was undoubtedly the Columbia, and the fact that it was known to the Missouris is an evidence that they were indeed great travelers, and this was true of many of the Indian tribes. The Osages rambled to Texas on the south, New Mexico on the west and Lake Michigan on the northeast. The New England Indians who were dispersed in the King Philip war were for a time located in Northern Illinois. La Salle had with him Indians from Maine. The Shawnees at different times were located in what are now the states of Pennsylvania, South Carolina, Kentucky, Ohio and Illinois, and other instances could be quoted if space would permit. The question of a route to the Pacific Ocean was at this time agitating the minds of many of the enterprising French located at Kaskaskia, and several "reports" were made to the home government setting forth the feasibility of a route by way of the Missouri. Father Charlevoix suggests the exploration of the river as follows: "I can make no doubt on weighing the information I have had from many places and which agree pretty well together, that by endeavoring to penetrate to the source of the Missouri one would find wherewithal to make amends for the charges and fatigues of such an enterprise." Of the Missouri and Mississippi the same writer says: "After we had gone five leagues on the Mississippi we arrived at the mouth of the Missouri, which runs north, northwest and south, southeast. I believe this is the finest confluence in the world. The two rivers are much the same breadth, each about half a league, but the Missouri is by far the most rapid and seems to enter the Mississippi like a conqueror, through which it carries its white waters to the opposite shore without mixing them, afterward it gives its color to the Mississippi, which it never loses again, but carries it quite down to the sea."

*Journal of a voyage to North America, undertaken by order of the French King, translated from the French, London, 1761.

NOTES AND QUERIES.

CHARITON.

In the map that accompanies the copy of Lewis and Clark that I have, Chariton is laid down as Charlatan, but in the text it is given as stated by Mr. Broadhead. Perrin DuLac, who ascended the Missouri river in 1802, gives in his "Voyage to Louisiane," published at Paris, 1805, an elaborate map of that river and its branches, on which the Chariton is laid down as Grand and Little Charleton. Brown's *Western Gazetteer*, published at Auburn, N. Y., 1817, has the name Charlatan. Breckenridge, in his "Views of Louisiana," published at Pittsburgh, Pa., 1814, calls it Charlatan and Chareton. Breckenridge ascended the Missouri in 1811. J.

What is the origin of the name of the Ozark Mountains? C. D.

In the early part of the present century, there was a fort on the Missouri river, between the Grand river and mouth of the Kansas, called Fort Osage, afterward changed to Fort Clark. Can any one tell me were it was situated?

OSAGE.

In the year 1797, a Welshman named Evans and an American named Mackay, ascended the Missouri river for several hundred miles and spent two years exploring the country. Was there ever any account (even if short) of their travels published; if so, where can it be found? AYTIQUARY.

The Otoes and Missouris claimed, during the war of 1812 with Great Britain, that Tecumseh sent them a belt, inviting them to join his confederation against the Americans. Is there any confirmation of this? OTOE.

MEDICINE AND HYGIENE.

PREVENTION OF DIPHTHERIA.

BY EDWIN R. MAXSON, A. M., M. D., LL.D.

To prevent diphtheria, and so finally exterminate it, every man, woman, and child, throughout our land and the world should be brought to obey the laws of life and health.

Parents should regularly feed, properly clothe, and duly restrain all children, before they come to the years of understanding and accountability. This alone would do much. A late prominent physician of Paris estimated that 3,000

children had died in that city, during the thirty years of his practice there, from short sleeves, short pants, and other kindred imprudence in the dressing of children. And I am fully convinced that as large a proportion are sacrificed, in towns at least, in this country, from the same cause—all for a *wicked* fashion. And from careful observation in this country and abroad, I am confident that at least as many more are carried off by improper food and irregularity in taking it, together with poisonous candies and other unwholesome and indigestible trash, that no child or person should eat.

Many of these, it is true, do not die of diphtheria. But it should be remembered that all this goes to predispose those not actually killed by depraving the blood and lessening the powers of vital resistance. And hence, when exposed to the *contagion* of diphtheria, or to putrid animal and vegetable exhalations, they are the first to take and most liable to die of it.

Children on attaining the age of accountability, and all other persons, should take plain, nourishing, and digestible food, with strict regularity, and nothing between meals or late at night. Trash, tobacco, intoxicating drinks, cosmetics, hair dyes, dime novels, etc., should be avoided by all. And while the amount of clothing should not be in excess, care should be taken to keep the arms, legs, and feet well protected, and all dress should be adapted to the season.

The person should be kept *clean*, without too much fretting of the skin by unnecessary washing, lest the urinary or other excretions should be called to the surface, thereby increasing personal filth, and injuriously deranging the various functions of the body. Sleeping rooms should be as far from the ground as possible; water should not be allowed in cellars, for a day even; and no decaying vegetables should be kept there.

Pure air should be allowed to pass into, and foul air out of, sleeping and all other rooms, without admitting dampness, or exposing the occupants to chilly night air more than can be helped.

No stagnant water should be allowed about a dwelling. And the back yards, where children play, should be kept exquisitely clean. Drains for sinks should be kept in order; and privy vaults should be cleaned out as often as twice a year, lime thrown in at least once a week, and if convenient, dry earth each day.

Heaps of filth should never be allowed about barns or out-houses. Hen coops, pig-sties, and rabbits' cages, if allowed, should be as far from the house as possible, and kept exquisitely clean; and no water should be used that could possibly contain decaying animal and vegetable matter.

Children should not be put to such kinds of labor as would expose them to injuries from filth, damp air, or other injurious influences. And adults should avoid such exposures as far as possible.

Now, as it was a deviation from all these rules of propriety which has predisposed to and kept up diphtheria, and all other kindred diseases, it is only by a return to these laws of health and rules of propriety, in every minute particular, that they are to be prevented and exterminated. And, while all this cannot be

accomplished at once, very much can be done *now*, and more ultimately, by getting right in all these particulars. And public hygiene, carrying out these principles in ample drainage, supplying pure water, cleaning streets, and suppressing all nuisances, may aid greatly in this work. And when a generation shall have been raised up with such habits and without the hereditary predisposition to this and other kindred diseases, children not inheriting it, properly cared for by their parents and obeying all the laws of life and health, may become in a great degree secure from the ravages of diphtheria, and hence of other putrid diseases. And as the body is the instrument of the mind, physical disease may not only be eradicated in the main, but the intellectual and moral powers of mankind will become proportionally elevated; and thus humanity may in a measure approximate Divinity, and become more nearly "allied to angels on the better side." Let us labor for this, then, as not only involving the *physical*, but also in an equal degree, the *intellectual and moral well-being of mankind*

BOOK NOTICES.

The Young Folks' Cyclopædia of Persons and Places, by John D. Chaplin, Jr., pp 936, 8vo; New York; Henry Holt & Co.; $3.50; for sale by M. H. Dickinson.

The success of "The Folks' Clyclopedia of Common Things," by the same author, encouraged him to undertake the book under consideration, which is devoted to accounts, written in a style readily comprehensible by children, of noted persons and places, both real and fabulous, thus supplementing the first, which was devoted to things in nature, science and art. Everything has been done in the way of illustration, description, pronunciation of words, etc., to make this work a most valuable one for school children and families, and in our judgment the effort has been far more than ordinarily successful. In looking through its pages we are surprised to note the amount of labor that has been bestowed upon it in collecting from all reliable sources, interesting and valuable information upon all possible subjects, historical, geographical and biographical. Teachers who can induce their scholars to purchase this book, will save themselves great labor and will contribute largely to the information as well as pleasure of their pupils.

Odontornithes; A Monograph On the Extinct Toothed-Birds of North America, by Othniel Charles Marsh; 4to, pp. 201; Illustrated; Washington, Government Printing Office, 1880.

The fact, that by far the most numerous and perfect bird fossils have been discovered in the cretaceous beds of Kansas and Colorado, renders this magnifi-

cent work the more interesting and valuable to the geologist of the West. Professor Marsh, who is among the first palænotologists of the present day, has spent the past ten years investigating this subject, much of the time in the field, associated with the local scientists, many of whom, like Mudge, Snow, St. John, Williston and others, have contributed all in their power to his success in searching out, discovering and classifying these wonderful remains.

The field is but comparatively unexplored, the material already discovered is sufficient for years of study and several volumes of description, while the results already attained, as Prof. Marsh observes, are full of promise for the future. This not only applies to fossil birds, but to gigantic reptiles and vertebrata of all kinds, including the first remains of Primates found in North America, also the first Cheiroptera, Marsupiala and Tillodontia.

This volume is devoted mainly to descriptions of the Toothed Fossil Birds, *Hesperornis*, which were very large swimming birds without wings and with teeth in grooves, and another group, endowed with great powers of flight and having the teeth in sockets and bi-concave vertebræ, best illustrated by the genus *Ichthyornis*. The illustrations consist of thirty-four plates and forty wood cuts, executed in the finest style of the engraver's art.

Professor Marsh has prepared a synopsis of this work with some of the most striking illustrations, which we hope to secure for publication in the REVIEW as a matter of special, and comparatively local, interest to our subscribers in the region in which these remarkable creatures and their no less remarkable associates once lived and flourished.

TRANSACTIONS OF THE KANSAS ACADEMY OF SCIENCE FOR 1879–80; Edited by the Secretary; Vol. VII; Topeka, Kansas; Geo. W. Martin; 1881.

This Academy maintains its work of investigating and exploring the geological, meteorological, archæological and geological conditions of its own State with unusual zeal and energy. The Professors of the State University, the Agricultural College, the Normal Schools and of Washburn College, Baker University and other literary institutions of Kansas, have, by common consent, united in their efforts to keep up the Academy and to make its work thorough and comprehensive. In the present volume are found over thirty papers, embracing seven articles upon geology and mineralogy, nine on zoölogy, three on meteorology, four on archæology and palæontology, two on botany, one on color blindness, one on irrigation, one on chemical apparatus, one on education, one memorial essay; also lectures by Prof. Geo. T. Fairchild, of State Agricultural College, and Prof. J. T. Lovewell, of Washburn College, and a description of the Aztec Ruins of the Pecos Pueblo in New Mexico, by Theo. S. Case.

The work consists of one hundred and thirty-six pages and is well arranged and indexed. It will be found of decided value to all interested in the remote past, as well as the present natural history of Kansas.

THE HYGIENE AND TREATMENT OF CATARRH, BY THOS. H. RUMBOLD, M. D.; 12mo; pp. 174; St. Louis, Mo.; 1880.

Dr. Rumbold has devoted many years to the study of catarrh and is as fully competent to discuss it as any physician in the country. In the volume above named, he mainly treats of this disease from a hygienic standpoint, giving rules and instructions for its avoidance and prevention, which, if observed, will certainly prove efficacious. We fully agree with the Arkansas *Medical Monthly*, that "it is a well written, concise and practical work, embracing a careful study of all the conditions which are liable to produce the diseases of which it treats. The relations which bad colds, bad teeth, clothing, head-wraps, bathing, exercise, diet, stimulants and use of tobacco bear toward the disease in question, are minutely considered. This is not only a good book for the specialist, and general practitioner, but one which they should advise the laity to purchase and study, that they may learn how to protect themselves from these too common affections."

OTHER PUBLICATIONS RECEIVED.

Bulletin of the Essex Institute, Salem, Mass., Oct., Nov. and Dec., 1880, Vol. XII.—Rogers' Birds Eye View of English Language, a chart 22x28 inches with rules for spelling, punctuation, use of capital letters, etc.; L. H. Rogers, New York, 25 cents.—Index to Papers on Anthropology, published by the Smithsonian Institution, 1847 to 1878, by Geo. H. Boehmer.—The Mississippi River and What its Proper Utilization will Accomplish; Toledo, O., 1881.—Library Aids, by Hon. John Eaton, Commissioner of Education, Washington, D. C., 1881.—On the Projection of Lines of Equal Pressure in the United States West of the Mississippi River, by Henry A. Hazen, 1881.—Abstract of Transactions of the Anthropological Society of Washington, D. C., with the Annual Addresses for 1880 and 1881. Edited by J. W. Powell. 1881.

SCIENTIFIC MISCELLANY.

GLASS SPINNING AND WEAVING.

Quite recently a glass firm in Pittsburg, United States, has succeeded to a notable degree, in producing glass threads of sufficient fineness and elasticity to permit of their being woven into fabrics of novel character and quality. Their success is such as to warrant the assumption that garments of pure glass, glistening and imperishable, are among the possibilities of the near future. The spinning of glass threads of extreme fineness is not a new process, but as carried on at present by the firm in question—Messrs. Atterbury & Co.—possesses consid-

erable interest. From a quality of glass similar to that from which table-ware is made, rods of glass, averaging half an inch in diameter, are drawn to any desired length and of various colors. These rods are then so placed that the flame of two gas burners is blown against that end of the rod pointed toward the large "spinning" wheel. The latter is 8½ feet in diameter, and turns at the rate of 300 revolutions per minute. The flames having played upon the end of the glass cylinder until a melting heat is attained, a thread of glass is drawn from the rod and affixed to the periphery of the wheel, whose face is about twelve inches wide. Motion is then communicated, and the crystal thread is drawn from between the gas jets and wrapped upon the wheel at the rate of 7,500 feet per minute. A higher speed results in a finer filament of glass, and *vice versa.* During its passage from the flame to the wheel, a distance of five or six feet, the thread has become cooled, and yet its elasticity is preserved to a n table degree. The next step in the process consists in the removal of the layers of threads from the wheel. This is easily accomplished, and after being cut to the desired lengths, the filaments are woven in a loom somewhat similar to that used in weaving silken goods. Until within the past few weeks only the woof of the fabric was of glass, but at present both warp and woof are in crystal. Samples of this cloth have been forwarded to New York and Chicago, and the manufacturers claim to be able to duplicate in colors, textures, &c., any garments sent them. A tablecloth of glass recently completed, shines with a satiny, opalescent luster by day, and under gas light shows remarkable beauty. Imitation plumes in opal, ruby, pale green and other hues, are also constructed of these threads and are wonderfully pretty. The chief obstacle yet to surmount seems to lie in the manipulation of these threads, which are so fine that a bunch containing 250 is not so thick as an average sized knitting needle, and which do not possess the tractability of threads of silk or cotton.

The weaving of such heavy fabrics of glass for ornamental purposes and for curiosities is no new thing, nor, in our estimation, does comparative success in such experiments warrant the enthusiastic claims of the Pittsburg manufacturers touching the adaptability of glass for wearing apparel. Unless it is in their power to change the nature of glass absolutely and radically, it does not seem possible for them to overcome the ultimate brittleness of the separate fibers as to make the fabric fit to be brought in contact with the skin. The woven stuff may be relatively tough and flexible, but unless the entire fabric can be made of one unbreakable fiber, the touch of the free ends, be they ever so fine, must be anything but pleasant or beneficial, if one can judge by the finest filaments of glass spun hitherto. Besides in weaving and wearing the goods a certain amount of fiber dust must be produced as in the case of all other textile material. When the softest of vegetable fibers are employed the air charged with their fragments is hurtful to the lungs, still more injurious must be the spiculæ of spun glass.

However, although the manufacturers are likely to be disappointed in their expectations of finding in glass a cheap and available substitute for linen, cotton, or silk in dress goods, it is quite possible that a wide range of useful application may be found for their new fabric.—*Journal of Applied Science.*

USES OF SAWDUST.

In most of our large cities, this material is not wasted, but has a commercial value and is eagerly sought after by parties who vend it. In New York this is notably the case. It is said that there are as many as 500 sawdust venders in this city. Years ago the mills were glad to have their sawdust removed; but since then there has been a growing demand for it, and the average price paid for it by the venders is about $3.50 per load. Special machines have been patented for grinding up shavings into coarse dust, which is prepared by some of the large mills for sale to the venders.

It is sold in large quantities to hotels, eating houses, saloons, groceries and other business houses.

It is moistened with water and strewn on the floors, where it serves the useful purpose of laying the dust, and makes sweeping up cleaner work. Plumbers use it constantly about their pipes; and builders to deaden walls and floors. Soda water men and packers of glass, china and other fragile wares, use it in considerable quantity. The markets and stables use considerable.

Yellow Pine makes the most desirable material for these uses; it is less dusty than other varities, and has besides a pleasant aromatic odor. But the dust of any of the white wood is indiscriminately used. Walnut dust is not in demand for these uses, and where it is possible to do so, it is burned.

It is estimated that there is capital of about $200,000 invested in the business of vending sawdust in this city. The quantity disposed of in the manner above described must therefore be immense.—*The Manufacturer and Builder.*

DISCOVERIES BY ACCIDENT.

Valuable discoveries have been made and valuable inventions suggested by the veriest accidents. An alchemist, while seeking to discover a mixture of earths that would make the most durable crucibles, one day found that he had made porcelain. The power of lenses, as applied to the telescope, was discovered by a watchmaker's apprentice. While holding spectacle-glasses between his thumb and finger, he was startled at the suddenly enlarged appearance of a neighboring church spire. The art of etching upon glass was discovered by a Nuremberg glass cutter. By accident a few drops of aqua fortis fell upon his spectacles. He noticed that the glass became corroded and softened where the acid had touched it. That was hint enough. He drew figures upon glass with varnish, applied the corroding fluid, then cut away the glass around the drawing. When the varnish was removed the figures appeared raised upon a dark ground. Mezzotinto owed its invention to the simple accident of the gun barrel of a sentry becoming rusted with dew. The swaying to and fro of a chandelier in a cathedral suggested to Galileo the application of the pendulum. The art of lithographing was perfected through suggestions made by accident. A poor musician was curious to know

whether music could not be etched upon stone as well as upon copper. After he had prepared his slab his mother asked him to make a memorandum of such clothes as she proposed to send away to be washed. Not having pen, ink and paper convenient he wrote the list on the stone with the etching preparation, intending to make a copy of it at leisure. A few days later, when about to clean the stone, he wondered what effect aqua fortis would have upon it. He applied the acid and in a few minutes saw the writing standing out in relief. The next step was simply to ink the stone and take off an impression. The composition of which printing rollers are made was discovered by a Salopian printer. Not being able to find the pelt-ball he inked the type with a piece of soft glue which had fallen out of a glue pot. It was such an excellent substitute that, after mixing molasses with the glue to give the mass proper consistency, the old pelt-ball was entirely discarded. The shop of a Dublin tobacconist by the name of Lundy was destroyed by fire. While he was gazing dolefully into the smoldering ruins he noticed that his poorer neighbors were gathering the snuff from the canisters. He tested the snuff for himself, and discovered that the fire had largely improved its pungency aroma. It was a hint worth profiting by. He secured another shop, built a lot of ovens, subjected the snuff to a heating process, gave the brand a particular name and in a few years became rich through an accident which he at first thought had completely ruined him.—*The Age of Steel.*

IRON AND WOODEN SHIPBUILDING.

The position of iron shipbuilding in this country, although limited, virtually, to a few establishments on the Delaware, is by no means so trifling as many newspapers would have their readers suppose. All well-equipped iron ship yards are full of orders, and there is every reason to believe they are doing a profitable business. An oft-repeated assertion, that large iron vessels cannot be constructed in this country with both pecuniary and mechanical success, is entirely unfounded. The high cost of labor and materials, as compared with their price in England, can be offset by the same ability and surpassing enterprise that enables our manufacturers to compete so favorably with British goods in foreign markets. Yet the advantages for building iron ships, in competition with the English, are somewhat different from those possessed by manufacturers of articles for stationary use. Our ocean-carrying trade can be, and mostly is, done in foreign bottoms, but our internal industries cannot be under foreign control—at least while a protective tariff remains in force.

As iron and steel for constructing, and steam for propelling vessels are rapidly superseding wooden-built and wind-power-driven ships, there would seem to be some good openings for ambitious capitalists and business men to start a few iron shipyards in the vicinity of New York City. We are credibly informed that there are now eighty iron steamships on the stocks in course of construction in Scotland, none of which are less than 3,000 tons burden, besides a great many others of

smaller capacity. All the large shipbuilding establishments in Great Britain seem to be full of work. On the other hand, the building of wooden vessels in Maine has been steadily declining. During the year 1880 ninety-two vessels, with an aggregate tonnage of only 35,847, were built in the state. This was less than half the tonnage of 1877, since which there has been a decline every year. It is useless to try to bolster up such an industry in the face of the much greater favor with which iron vessels are regarded. We should not be so far behind our British cousins in this very important industry. There is a growing demand for iron river and excursion boats, which alone will sustain several shipyards.—*American Machinist.*

EDITORIAL NOTES.

THE reception which the first number of the fifth volume of the REVIEW, in its improved form, has met with is very encouraging and flattering to its editor, but the publisher's department suggests that such improvements cost a good deal of money, and that a hundred more subscribers would be exceedingly welcome.

THE meeting of the Missouri Press Association for the year 1881, was a memorable one for many reasons, but principally, aside from the instruction and entertaining exercises of the meeting itself, on account of the hospitality of the people of Jefferson City; the excessive courtesy of the Chicago and Alton Railroad Co., through its officers Mr. Charlton and Mr. Bowes; the polite attention of Mr. Palmer, of the Palmer House, Chicago; the liberal concessions of the Pittsburg and Ft. Wayne Railroad, through Mr. Ford and Mr. Adams; the urbanity of Capt. Blake, of the Mt. Vernon steamer "Corcoran," and finally, the unwearying good offices of Senators Cockrell and Vest, and Messrs. Burdett, Clements and Morrow at Washington City. Everything was promptly and cheerfully done to make the excursion pleasant, and every effort was eminently successful.

THE commencment exercises at the Kansas State University will be held from June 3d to June 8th, and will undoubtedly prove of great interest to such of our readers as may attend.

THE local gas company, accepting as a challenge the admiration evoked by the Swan electric lamps, at present lighting the thoroughfares of Newcastle, England, recently placed at the corner of one of the streets, in close contiguity to the electric light, one of Bray's three-light lamps. The lamp was obscured at the top, and the effect is described as very striking, its illuminating power being pronounced excellent. The advocates of gas-lighting claimed a victory for the old over the new mode and power of illumination.

THE *Review* is well appreciated by western readers and we are glad to see that it is receiving flattering recognition from some of the ablest eastern journals and is favorably known to scientists in England. The *Review* is the only periodical of its practical character in the West, and under Mr. Case's careful and excellent management, is a feature of our literature that we are all proud of.—*Topeka Capitol.*

THE Mineral Springs of Clay county, this State, are attracting a great deal of attention just now. We shall visit some of them soon and report through the columns of the REVIEW.

THE fifth volume of *The Kansas City Review of Science and Industry* was begun with the May number. This publication is a popular one, comprising articles by the best writers, and selections from the best periodicals in this country and in Europe, upon geology, mining, medicine, hygiene, explorations, travels, biography, etc. Every number is almost a library in itself. Theo. S. Case, the editor of the *The Review*, is one of the best known writers in the West.—*Leavenworth Times*.

THE Kansas State Teachers' Association meets at Manhattan, June 21, 1881. Among other prominent teachers "billed," we notice the name of Prof. J. M. Greenwood, of this city. The occasion will doubtless be full of interest and profit to all attending.

CAPT. J. M. TROWBRIDGE, C. E., informs us that the narrow track railway described in the last issue of the REVIEW, is two feet gauge instead of ten inches. We presume he is correct, although the item was received from a reputable source.

THE *Kansas City Review of Science and Industry*, edited by Theodore S. Case, is a border monthly which will compare very favorably with periodicals of its class published nearer old world centers. It obviously has an intelligent local support, and deserves to be better known in other quarters.—*Cincinnati Gazette*.

OUR Ellsworth contributor, Chas. H. Sternberg, is now in western Kansas collecting fossil specimens. He has already sent several new species to Professors Lesquereux and Agassiz. We hope to publish some of the results of his work to the July REVIEW.

THE May number of the *Kansas City Review of Science and Industry* is the commencement of volume five. We are glad to see the size of the page somewhat increased, while the matter is kept fully up to the standard. One of the best publications in the country. —*Boston Journal of Commerce*.

THE annual meeting of the Missouri State Teachers' Association will take place at Sweet Springs, (Brownsville) Mo. It will begin on the evening of Tuesday, June 21st, and continue through the 22d, 23d and 24th. Every friend of education is requested to further, by his presence, the objects of the Association.

COMMANDER COOPER, commanding the United States Steamer Alliance, now at Norfolk, Va., has been ordered to prepare his ship with all dispatch to proceed on a cruise in search of the Jeannette, between Greenland, Iceland and the coast of Norway, and as far as the northern coast of Spitzberger, if it is possible to get there without endangering the vessel.

WE learn from the official report that Kansas City is the 30th city in point of size in the United States, the 16th in the number of letters mailed, and the 3d, including Washington City, in the average number mailed by each person during the year 1880. The actual number of letters mailed was 5,706,227, or 102.23 for each inhabitant.

THE reports from Atlantic vessels show that the number of icebergs and the amount of ice floes in the ordinary path of commerce is greater at present than ever before at this season of the year.

THE *Review* is, aside from general science, a local publication, and gives not only facts and information of local interest, but its science is Western, and its articles sufficiently practical to make it racy of the soil. Missouri, Kansas, Colorado, New Mexico and the West furnish the topics and, what is better, the writers; and its information is nowhere else obtainable. And we know if the intelligent people of the city and the country around generally knew the importance of its contents and the good work it has done and is doing for our soil, climate, mines and general interests, the enterprising publisher would be a great deal better rewarded than he is, proud as he is to be able to keep it alive. It is a treasure to any intelligent Western man.—*Kansas City Journal*.

ITEMS FROM THE PERIODICALS.

THE *American Naturalist* for June, presents the following table of contents: Archæology of Vermont; Larval Habits of Bee-Flies; Late Explorations in the Gaboon; Pueblo Pottery; Botany; Zoology; Entomology; Anthropology; Geology and Palæontology; Geography and Travels; Microscopy, etc., etc Several of the articles are illustrated, and the number contains a map of Franz-Joseph Land.

THE *Educationist*, Volume III, number 5, published by G. W. Hoss, at Topeka, Kansas, is before us; a 24-page monthly, neat and attractive in appearance as it is substantial and valuable in matter. $1 00 per annum.

THE *Humboldt Library*, No. 22, Vol. 1, J. Fitzgerald & Co., New York, gives its readers for the sum of 15 cents the whole of Professor Wm. K. Clifford's volume on Seeing and Thinking, with all of the engravings illustrating the original.

THE *Atlantic Monthly*, for June has several new features which will commend it to a host of readers. So far, the *Atlantic*, under Mr. Aldrich's editorship, does great credit to his care and judgment. He will undoubtedly prove a success.

THE Clinton, (Wis.,) *Herald*, whose editor, Dr. Stephen Bowers, is one of the best known American archæologists, refers to the REVIEW very pleasantly, thus:

The KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY for May has reached us, and is brim full of good things.

* * * * * * * *

The editor gives us in each number a review of the progress of science in this country, which, owing to its clever and popular style is of interest to all classes of readers. This excellent western magazine should have a large subscription list.—*Clinton, Wis., Weekly Herald.*

AMONG the best articles in *Popular Science Monthly* for June are Physical Education, by Dr. Oswald; Sunstroke and some of its Sequelæ, by Dr. J. Fayrer; The Value of Our Forests, by N. H. Egleston; The Modern Development of Faraday's Conception of Electricity, by Prof. A. Helmholtz, and the Editor's Department, which last is always a model of condensed science.

THE Boston *Journal of Commerce* comes out in a new dress, and makes the following robust and gratifying announcement: "We print 7,596 copies of this issue of the Boston *Journal of Commerce*, 6,620 of which are our subscribers, exchanges and newsdealers, and the balance are sent abroad as specimen copies. The "Little Basket" of a year ago has been laid by."

MR. GEO. A. BATES, of the Naturalists' Bureau, Salem, Mass., is about to resume the publication of Prof. Ernest Ingersoll's "Natural History of the Nests and Eggs of American Birds." It will be issued in monthly parts, magnificently illustrated, and will include the birds of the whole of North America north of Mexico, their habitat, their date of arival, materials and sites chosen for nests, detis of incubation, birth and care of young birds, etc. Prof. Ingersoll has made a specialty of this subject and will give to the world a standard work. Price 50 cents per number, or $5.50 per annum.

WHEN our attention was first called to this publication, we hardly knew which to envy most, the bravery of the editor or his bank account, for the idea of a successful *Review of Science* on this side of the Mississippi and amid our peculiar surroundings, seemed to us almost preposterous. But upon more intimate acquaintance with the *Review* and seeing the real excellence secured by the painstaking labor of the editor, the high character of its articles and the beauty of its mechanical execution, our wonder is that the *Review* has not done even better than it has.—*Mid Continent.*

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KANSAS CITY

Review of Science and Industry,

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SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. V. JULY, 1881. NO. 3.

GEOLOGY AND PALÆONTOLOGY.

GEOLOGICAL NOTES ON THE CENTRAL BRANCH UNION PACIFIC RAILROAD.

BY PROF. GEO. C. BROADHEAD.

At Atchison, the River Bluffs expose the following sections, numbering from the top:

1. Three feet red clay and soil.
2. One foot boulders, gravel and sand.
3. Four feet red clay.
4. Five feet sand beds in horizontal bands.
5. One foot sand and pebbles.
6. One foot fine sand of yellowish color.
7. Six inches more sand.
8. One foot sand with a few roots.

These may be referred to Loess. The beds resting below are Upper Carboniferous, as follows:

9. Sixteen feet irregularly bedded limestone, chiefly in six inch layers. Corresponds to No. 150, of Geological section of Upper Coal Measures. See Missouri Geological Report, 1872.

10. Four feet brown clay shales.
11. Four feet Bituminous shales.
12. Twenty inches even bed of limestone.
13. Thirty feet shales to railroad.

No. 9, of section above (150 U. C. M.), caps the Missouri Bluffs at most places in Buchanan County, Mo., and affords the principal rock used for foundations at St. Joseph, and also extensively burned into lime at the latter place. Some of its beds abound in *Fusulina Cylindrica*, *Chonetes Granulifera*, and an *Allorisma* is often found near its base. The teeth of two species of fish have also been obtained from it above Weston. At St. Joseph it often abounds in *Orthis Carbonaria* (*O. pecosii*). Handsome specimens of Bryozoans have been obtained from it near Amazonia and also Savannah, Mo.

At the quarries, one mile southwest from Atchison, we find several feet of limestone, (No. 152, U. C. M.), where it has been considerably quarried for foundations of buildings, curbstones, etc.

About eight feet thickness was observed in layers of from a few inches to over a foot. It is a bluish gray, strong limestone, evenly bedded, but sometimes cross laminated, and weathers an iron gray. It is nearly everywhere easily recognized by a two inch layer of "cone in cone" on upper surface. This was observed at Atchison, has also been observed on the other side of the river, near Sugar Creek Lake in Buchanan and in Andrew Counties. It was formerly hauled from near Savannah to St. Joseph and used in buildings.

Near the railroad no such exposures are again seen for 80 miles.

In Marshall County, Kansas, boulders and sand beds of the Drift were occasionally observed. Among the boulders recognized were those of granite, quartzite and greenstone. But little evidence of Drift observed beyond 100 miles.

At Frankfort the hills extend up probably 150 feet above the Vermillion valley and seemed formed, in the lower portion, chiefly of shales for over 50 feet with probably one limestone suitable for building, near the lower part. These beds I refer to are the Middle Permian, the Lower probably cropping out eastwardly.

Toward the top of the hill about four feet of good building stone is quarried. In the quarry it is an ash-gray Magnesian limestone, weathering cream color and works out very freely. The quarry rock is of a very porous texture, caused by the decomposing and loss of numerous *Fusulinæ:* it also contains many chert concretions, which does not seriously interfere with its use as a building stone.

Five miles west the same beds appear in bluffs, but low down, at Barrett's Station.

Still further, several miles, at Bigelow Station, these beds are well exposed, and the stripping exposes to view better layers of stone. A good deal of quarrying has been done here, and preparations are making for much more.

In the beds I observed the following fossils: *Productus semi-reticulatus*, with *Fusulinæ* very abundant, but other fossils very rare.

The following is about a general section of rocks seen at Blue Rapids, ten miles further west, and includes beds still above those just named, and also Permian:

1. On hilltop a bed of limestone near summit.

2. 100 feet probably all shales; same chert on slopes.

3. Four feet Magnesian limestone in layers of four to twelve inches.

4. Fifteen feet shales with small geodes.

5. Four feet limestone in sixteen inch layers; color, whitish drab with blue chert between the layers. This limestone is much used in building at Blue Rapids, and affords a handsome building rock.

6. Thirty feet shales.

7. One and one-half feet good bed of building stone, coarsely cellular; also extensively used.

8. Thirty feet shales, red in lower part.

9. Four feet limestone.

10. Four feet nodular shales.

On river bluffs above, the red shales at several places carry lenticular forms of gypsum, often snowy, and in quantity sufficient to utilize. There is a mill at Blue Rapids constantly engaged in grinding it up for plaster. Some of these beds are nine feet thick. A strange feature was observed in some of the lower beds of these rocks. In five feet thickness observed four beds of rock of nearly uniform thickness, sixteen to twenty inches, each one with a layer of blue chert on top.

Fusulina cylindrica abounds, also found *Atthyris subtilita*, *Productus semireticulatus*, *Chonetis granulifera*, *Eumicrotis haurii*, *Hemipronites crenistria*.

Borings at Blue Rapids reveal a thin coal seam, only a few inches.

Five miles west, at Waterville, we find the rock corresponding to that on hilltop at Blue Rapids, but here it lies not far above base of hill, and is the chief rock used for building purposes. It also corresponds to the Mayville rock.

At Palmer Station we find that we have left the Upper Carboniferous and Permian and entered the Cretaceous. The red sandstone of the Dacotah stands out prominently at Palmer. At Concordia this sandstone lies low in the hills, and is used in the construction of buildings, as is also the lower beds of the Ft. Benton Cretaceous. At Beloit and Cawker they obtain a ten-inch bed of very tough limestone, but at the same time soft enough to saw or cut easily. Half the buildings of these towns are constructed of it. It is a yellowish brown color with a dark brown or red band at the center, along which it can be split.

Inoceramus problematicus was almost the only fossil seen.

At Glen Elder there is exposed about thirty feet of shales, and thin limestone layers of the Ft. Benton group. Off from the railroad these beds contain *Ammonites*.

A wonderful thing is the Spirit Spring three miles east of Cawker. We here find a knoll of thinly laminated rock about twenty-five feet high, 100 feet across at summit and 300 feet at base. Between this knoll and adjacent bluff lies a hollow twenty-five feet deep. The slope is gradual on all sides except the south, where it is perpendicular. On top we find a spring sixty feet in diameter, and having a margin of not over twenty feet outside of the water to connect with the

descending slope. The water is strongly saline, and depth reported to be over 100 feet. Water is constantly at surface and trickles over gently. The Indians are said to have ascribed great virtue to it, or rather to have worshipped it as a "totem," or medicine — their WAKONDA, which name is now often applied to it.

Beyond Cawker we soon find higher rocks of the Cretaceous. Above Portis, at Kirwin, Logan, and Bull City, the white and cream colored beds of the Niobrara group appear. Much of this rock is of snowy whiteness or cream color, easily cut or sawn, and can be readily whittled with a knife. One-half the buildings of these towns are constructed of it. It looks very handsome, is not strong, nor will a wall built in a damp place stand wet and frost. It does well in the absence of better. The rock contains *Haploscapha Rudistes* and *Ostrea.*

At Bull City on South Solomon, in Osborne county, about twenty-five feet is exposed, resting on fifty or more feet of dark shales. Some of the beds of this formation contain fossil fish and those wonderful *Saurians.*

ARCHÆOLOGY.

PREHISTORIC MAN IN AMERICA.

(*Concluded.*)

BY PROF. EDWARD S. MORSE.

If we now look at civilized man, we find him distributed in every part of the world, and history and tradition in most cases give us information as to the manner of this distribution. Believing that in past times, as at present, colonizing went on in similar ways, we infer that neolithic man became more widedly scattered than his predecessors. Whenever we turn our eyes, from one side of the earth to the other, the age of polished stone implements at one time existed. More important still is it to consider that paleolithic man seems to be just as widely distributed. His remains in river-drift and other places have been found in England, France, Portugal, Greece, Italy, Africa, Palestine, the Indian Peninsula and Northern India, New Jersey, and California. Thus we have this early man spread over nearly the whole world; and, so far as we can judge from his rude implements, identical under all conditions of climate and surroundings. Surely such a distribution must not only indicate an enormous lapse of time, during which he remained in this condition and slowly found his way to different parts of the world, but must of necessity, presuppose the existence of a more primitive people from which these had sprung. Had these also become so widely scattered? Compare these rude men with those of Europe, and consider how long a knowledge of the Western Hemisphere was hidden from the latter. How infinitely slow must have been the colonizing of continents in paleolithic ages and in ages more remote!

These considerations, in regard to the not improbable existence of man in the middle, and, possibly, in the earlier tertiaries, are offered that the reader may be better prepared to appreciate the remarkable discoveries of the remains of man in the auriferous gravels of California. An elaborate memoir on this subject, by Professor J. D. Whitney, has just been completed in a second part, forming one of the publications of the Museum of Comparative Zoology at Cambridge.

Professor Whitney, formerly the director of the geological survey of California, has, in the memoir referred to above, described at great length the evidences regarding the genuineness of the famous "Calaveras skull," repudiated as a hoax by the press generally, made doubly famous by the witty verses of Bret Harte, and looked at with suspicion or ignored by archæologists of great repute. The reader must be referred to the pages of Professor Whitney's memoir to appreciate the force of the evidences he there brings forward in support of the claims he has made regarding the genuineness of the occurrence of human remains from beds of pliocene and possibly of miocene age. Were this skull the only object of this nature that had been found in the auriferous gravels, one might perhaps be justified in questioning it.

The truth is, however, that in ten different counties in that great region, remains of man, associated with extinct mammals and buried at great depths in the auriferous gravels, have been brought to light. It is true that in many cases the evidences have been produced by miners, but among that class are many intelligent men. In their vocation, too, they are specially seeking for definite objects, namely: particles of gold. Their experience is not like that attending the rough excavations of railroad cuts or canals. Their work has been accompanied by a scrutiny which adds positive weight to their statements. Of great importance, too, is the uniformity of their testimony, as Professor Whitney points out, and the invariably rude character of the implements which they produce from these beds. Any attempt at deception would certainly bring with it some rudely carved image, or stone with rude characters engraved thereon. No collusion is conceivable between so many observers, covering so many years, and working in so many widely separated localities.

Among the many notable examples cited by Professor Whitney, that of the occurrence of human remains beneath Table Mountain is the most remarkable. In this case, tunnels had been driven in horizontally beneath the basaltic cap of the mountain, which is of great thickness. The tunnels being horizontal, there was do possibility of *débris* falling from above, with the chance of conveying surface specimens. The great age of the gravels beneath Table Mountain is shown by the profound geological changes which have taken place in the surface features of that region since the volcanic outflow formed the almost imperishable cap which has preserved this area and similar areas from the wide denudation that has taken place around. The basalt forming the cap of Table Mountain extends in an even plateau, though interrupted by deep gorges and cañons, for a distance of twenty miles, with a descending grade, as measured by barometric

observations, of about eighty feet to the mile. It is inconceivable on any hypothesis that this ancient lava-flow could have followed any mountain ridge or spur. Indeed, all the evidence goes to show that it followed an old river-bottom, with its superimposed beds of gravel and horizontally depostted layers of sand and clay.

While this lava-stream formerly occupied a river-channel, presumably depressed below the surrounding country, now this consolidated mass stands far above the deep gorges and cañons that have been furrowed out since. In other words, this region, once a valley, is now in turn a mountain! The enduring nature of the basalt has partially protected these plateaus from the universal erosion of that area. Beneath this basaltic mountain tunnels have been run, in one case to a distance of nearly a third of a mile.

The old river-bed upon which Table Mountain rests has been found, with its characteristic worn pebbles and bowlders, and gold has been got in precisely such positions as it would be found to-day in existing rivers. And from these tunnels, even from one which measured nearly a third of a mile in length, the remains of man in the shape of his actual bones, as well as beads, rough pestles, and other relics of human fabrication, have been brought to light, and these discoveries have been made, not by one man, but by many. Their sworn statements are given, and the specimens collected by different people, at different times, now enrich the collections of the California Academy of Natural Sciences, the Philadelphia Academy of Natural Sciences, and the Museum of the Boston Society of Natural History.

In regard to the famous skull itself, we can do no better than to quote from Professor Whitney's preface to Part II, wherein he says that "all those who refuse to accept my conclusions as to the great antiquity of man in California, do so on the ground that the Calaveras skull was not taken from its bed by the hand of a scientific man. In so doing, they not only ignore the evidence presented by the skull itself, which is positively a fossil, and was chiseled out of its gravelly matrix in the presence of several eminent authorities, but they also reject the very full testimony from other quarters, some of which comes from men of education, and even of professional education. The body of the other evidence is so great that it does not appear to me that it would be materially weakened by dropping that furnished by the Calaveras skull itself."

The voluminous testimony offered by Professor Whitney will impress all who read this volume dispassionately.

In regard to the age of these remains, Professor Whitney says that "it will be safe to say that the human race in America is shown to be, at least, of as ancient a date as that of the European pliocene; and to have an idea how far that epoch is from the present one, it is only necessary to recall the amount of erosion which has taken place since the cessation of volcanic activity in that part of the sierra in which lie the formations which have been described in the present volume."

Whatever age geologists may ascribe to the auriferous gravels, sufficient proof, in our mind, has been adduced to show that man lived at the time of their deposition, and that the mammals and plants then living are now extinct. The plants, according to Lesquereux, are of pliocene age, and some identical with, or closely allied to, miocene forms.

On the eastern coast of North America, we have the important discovery, by Dr. C. C. Abbott, of true river-drift implements in the Delaware Valley of New Jersey. From the testimony of eminent geologists the Trenton gravels were deposited at the foot of the retreating ice-sheet. In the Tenth and Eleventh Annual Reports of the Peabody Museum of American Archæology and Ethnology, Dr. Abbott has published full accounts of his discoveries. The implements were obtained from depths ranging from five to ten feet below the surface, These are precisely of the same nature as those characterizing the river-drift men of Europe. If Dr. Abbott's conclusions are correct, then the gravel-beds in question are a part, so to speak, of the glacial epoch.

That man existed contemporaneously with their deposition, there can be no doubt.*

The probable relation of the paleolithic man of Europe with the Esquimaux of North America has been suggested by Professor Dawkins, and Dr. Abbott supports this supposition with other evidences. In this connection, it is interesting to remark that while the breadth of the Calaveras skull, according to Professor Wyman, agrees with the other crania from California, except that of the Digger Indian, it differs in dimensions from other crania, and in these differences it approaches the Esquimaux.

The wide distribution of these remains, from distant India throughout Europe and across the American continent, shows a race, judging from their implements, apparently homogeneous, and indicates an immense lapse of time for the dispersion of these people. Their precursors must be recognized by their bones, for implements, to be distinguished from ordinary stones, are not to be expected. The improbability of encountering these remains has already been pointed out.

If man has descended from some ape-like progenitor, or, rather, if he and the present apes are derived from a common ancestor, then we must expect to find the early remains of man closely drawing near, in his characters, to that hypothetical form which is looked for in "the missing link." Thus far all the characters of the early remains of man point distinctly in that way, though many a long gap must yet be filled before the sharp lines of demarkation between the higher groups break down. From the exceeding rarity of the remains of the order of primates, the different groups stand quite as isolated as man from them. Not to speak of the gaps yet to fill between the different genera of the higher

*If the views of Mr. Henry C. Lewis regarding the Trenton gravels are correct, then their connection and superposition on the red gravel and brick clays indicate a second and much later glacial period, corresponding to the reindeer period of Europe. Whatever the facts may show, the identity of the Trenton river implements with those of the river-drift of Europe seems well established.

apes, a great gap separates the true apes from the half-apes or lemurs, and these in turn have affinities with the most aberrant and puzzling forms, like the aye-aye and tarsier, with its extraordinary long tarsal segment, so that we have the affinities of man brought by quick passage, as it were, to the lower levels of the mammalia; and in this connection it is interesting to observe that in the lower eocene, both in Europe and America, lemuroid forms have been discovered.

In recalling the low characters of ancient man, it is not necessary to mention here the oft-repeated examples of the Neanderthal and Engis skulls of Perigord, the jaws of La Naulette, Moulin Quignon, and a host of other examples now classic in the literature of the subject, and the equally remarkable remains in this country, such as the platycnemic tibiæ of Michigan, and the remarkable skull from that region, with the temporal ridges nearly approximating. Suffice it to say that, just as we find the remains of man at lower levels, so do we find his characters in the main departing not only from the higher race of to-day, but in the same proportion approaching a type which is ape-like. If we examine the races to-day we find the savage groups presenting a number of low characters, such as a deficiency of the sharp ridge at the base of the nostrils, differences in the proportion of of the pelvis, in some the foramen magnum farther back; a certain percentage of perforated humeri, prognathism, and other characters, all of which are an approach to the apes, and a departure from higher man. No one savage race possesses all these characters, but each race has some of them. If we look for these characters among the higher races, we meet with them rarely. Thus, the percentage of perforated humeri in the white race is very low. Of fifty-two humeri examined by Wyman, only two were perforated. In the present Indian and Negro, this peculiarity occurs more frequently, and in the prehistoric races of America is very common. Wyman found in a Florida mound thirty-one per cent perforated, while Gillman estimated the percentage of perforated humeri in a Michigan mound as at least fifty per cent. He has furthermore pointed out the interesting fact that these low humeri are associated with successively flattened tibiæ.

If now we note successively the percentage of low characters revealed in the higher races of to-day, in existing savages, in the races, both savage and civilized, at the dawn of history, and finally, in those savage races which alone existed in neolithic and down through to paleolithic times, we find this percentage becoming greater as we descend. So marked is the increase that one may almost predict that, when still more remote horizons yield their human remains, an enormous percentage, if not at all, will be found with low, receding foreheads; heavy frontal crests; rounding of the base of the nostrils; a nearer approximation of the temporal ridges; a greater posterior position of the foramen magnum; the absence of a projecting chin; ape-like proportions of the molar teeth; perforated humeri; quadrumanous proportions of the pelvis; flattened and saber-like tibia; conspicuous roughnesses and ridges for the attachments of muscles, and other low osteological characters, all pointing in one direction. Of the soft parts, the amount of hairiness and the racial character of the hair, the persistence of ape-like muscles,

which at the present time occur but rarely, or of their habits and mental attributes, nothing, of course, can be known.

These characters, when found, will have become merged so completely with those of the ancestors on another line that new genera will have to be erected to embrace them. This conclusion brings no strain upon the accepted methods of logical deduction. For these remains we are still seeking.

There are many species of mammals whose early progenitors are not known, and, though many wide and important gaps in conspicuous groups of mammals have been filled up, thanks to the labors of our American paleontologists, there are many "missing links" in the groups as well as in that group to which we belong. The intense impatience to fill this gap in man's genealogy arises from the special interest that man naturally feels in his own species. How long we have patiently waited for those links which Geoffroy St. Hilaire so earnestly looked for—the closing up of wide gaps between the paleotherium, hipparion, and horse; and who could have foretold in his day that, in the wild regions far beyond the Mississippi, amid hostile savages, these precious remains would be brought to light!

Many other intermediate forms, of equal importance in forming connected series, though not so well known to the public, have been discovered by Leidy, Marsh and Cope. Indeed, such intermediate and generalized forms have been added to the mammalia that we have creatures combining the characters of the pigs and ruminants, animals possessing the characters of the hoofed beasts, carnivora, and rodents! Professor Flower, the distinguished English osteologist, confesses that the modern classification of mammals completely breaks down in the light of these revelations. Cuvier's law of the "Correlation of Structures," although applicable within certain limits, would have led him into the gravest errors as applied to the fossils known at present. Professor Marsh, in his address on the "History and Methods of Paleontological Discovery," says that if Cuvier "had before him the disconnected fragments of an eocene tillodont, he would undoubtedly have referred a molar tooth to one of his pachyderms, an incisor tooth to a rodent, and a claw-bone to a carnivore."

The sharp lines of demarkation which discriminate the various groups of mammals in Cuvier's day have been, in many cases, rounded off or completely obliterated. Man, who is still seeking his own phylum with those of many other species of mammals, must patiently wait.

Huxley, in his courageous little book on "Man's Place in Nature," published nearly twenty years ago, closes by asking the question: "Where, then, must we look for primitive man? Was the oldest *Homo sapiens* pliocene or miocene, or yet more ancient? In still older strata do the fossilized bones of an ape more anthropoid, or a man more pithecoid, than any yet known, await the researches of some unborn paleontologist? Time will show; but, in the meanwhile, if any form of the doctrine of progressive development is correct, we must extend, by long epochs, the most liberal estimate that has yet been made of the antiquity of man."—*North American Review.*

GEOLOGICAL CHART;

Including the Rock Scale of Geological Periods and the "Zoic Calendar of Creation." Compiled from the works of Agassiz, Lyell, Huxley, Hæckel, Dana, LeConte, and other first rank authorities in Science at the present time. By HIRAM A. REID, Secretary State Academy of Sciences at Des Moines, Iowa. [Published by permission of the Author.]

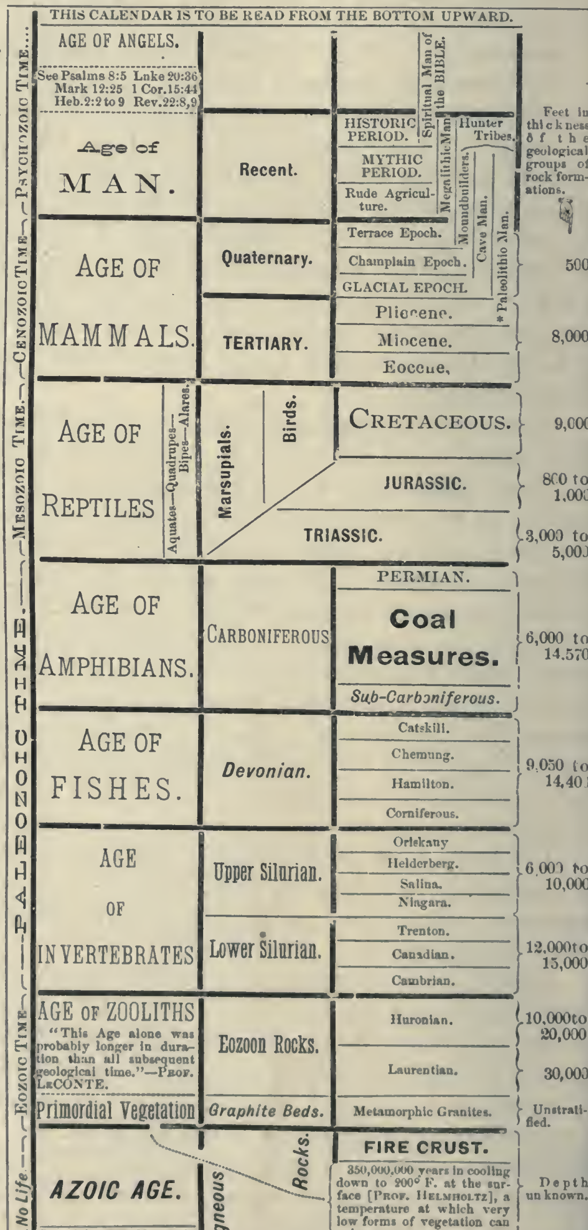
EXPLANATION.—The side line at the left shows what portions of geological time are comprehended in the terms "eozoic," "paleozoic," etc. The first column shows the periods or "Ages" of geological time during which the different successive types of animal life predominated, or were the highest types then in existence. And these two divisions form the "Zoic Calendar of Creation."

The second column shows the great general groupings of rock strata, in which are found the fossil remains of the corresponding animal types named in the first column. But, at the "Age of Reptiles" occurs a grand divergement, for it was during this age that animal life pushed out into its most wonderful developments; and there came into existence strange and marvelous forms of swimming reptiles, four-footed and two-footed walking reptiles, and two-footed and four-footed flying reptiles. Here also the true birds began to appear, though with reptilian peculiarities; and likewise the marsupial animals, which are a transitional type, between reptiles that produce their young by laying eggs and the true mammals, that bring forth their young well matured and then suckle them.

The third column shows the lesser groupings of rock beds as classified by our American geologists; but many minor subdivisions and local groups are omitted for want of space. At the top of this column are shown the geological periods of first appearance of races of man, so far as now authenticated by competent scientific authorities.*

The fourth column shows the number of feet in thickness of the different groups of rock layers as indicated by the braces.

This Chart is the most comprehensive and thorough in its details, and yet the most systematically and graphically presented to the eye, of anything in its line that has ever yet been published. Here is the whole story of geology and the ascent of life condensed into the space of a few inches, yet so plainly set forth as to readily fix itself in the memory like an outline map. Scientific terms in newspapers and magazines often catch the reader at a disadvantage; but a reference to this chart will at once show the relative place or period in creational progress to which the best authorized geological terms apply. It reaches, like a Jacob's ladder, from the lowest inklings to the highest ideals of life on the earth, as taught by modern science and the Christian Bible.



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* "The existence of Pliocene man in Tuscany is, then, in my opinion, an acquired scientific fact." — See Appletons' International Scientific Series, Vol. XXVII, p. 151. "The Miocene man of La Beauce already knew the use of fire, and worked flint." — Ib. p. 243. See also, Prof Winchell's "Pre-Adamites," pp. 426-7-8. "The human race in America is shown to be at least of as ancient a date as that of the European Pliocene."—Prof. J. D. Whitney. Similar views are held by Profs. Leidy, Marsh, Cope, Morse, Wyman, and other scientists of highest repute.

HISTORICAL NOTES.

FORT ORLEANS ON THE MISSOURI.

JOHN P. JONES, KEYTESVILLE, MO

The exact location of this French fort, or post, is at present unknown, and cn only be determined approximately by locating as near as possible the former ome of the Missouris, as all the early French writers who mention it agree that t was near the principal village of that tribe.

Dumont,* one of the earliest and best of the French annalists, gives an ex-ended account of the erection of the fort, but says nothing positive as to its loca-ion, except that it was in the "vicinity of the Missouris." Du Pratz,† in his *Historie*, says: "For some time there has been a French post on an island of some eagues in length opposite the Missouris. The French have established this fort t the east point, and named it Fort Orleans. M. de Bourgmont has been in com-nand there long enough to gain the friendship of the nations of the country near his great river, and to make peace among them."

M. Bossu, a Captain in the French service, who published two volumes of ravels in Louisiana,‡ mentions the fort as being near the Missouris. In another lace he says: "Baron Parneuf, who has been Governor at Fort Orleans, estab-ished in the nation of Missouris, and who knows the nation well, has informed ne that they were formerly very warlike, etc."

From these quotations it will be seen that the fort was unquestionably located ear the Missouris, and if we can determine their location, we shall be able to ery nearly establish the position of the fort. M. Dutisné, of the Kaskaskias, who isited the Missouris in 1719, says in his letter to Bienville§ narrating the trip: 'It is eighty leagues to the village of the Missouris by the river of that name."

Father Charlevoix, one of the best informed of the early writers on Louis-ana, says in his journal under date of October 20, 1721: "I have just now seen Missouri woman, who told me that her nation was the first we meet going up ne Missouri. It is situated eighty leagues from the confluence of that river with ne Mississippi."

Eighty leagues would make the location of the village, or home, of the Mis-ouris near the present mouth of Grand River, in Chariton county, and travelers ho ascended the Missouri in the early part of the present century corroborate the atements of M. Dutisnè and Father Charlevoix.

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*Historical Memoirs of Louisiana. By M. Dumont, 2 vols.: Paris, 1753.

†History de la Louisiana. By Le Page Du Pratz, 3 vols.: Paris, 1758.

‡New Voyages, etc , containing a relation of the different people which inhabit the environs of the Grand iver St. Louis, generally called Mississippi, etc., 2 vols. By M. Bossu, Captain in the Marines: Paris, 1768.

§Historical Journal of the establishment of French in Louisiana. By Bernard de La Harpe: Paris, 1831.

Lewis and Clarke,* who ascended the river in 1804, mention the village as follows: "On the 13th we passed a bend of the river and two creeks on the north called the Round Bend Creeks.† Between these two creeks is the prairie in which once stood the ancient village of the Missouris. Of this village there remains no vestige, nor is there anything to recall this great and numerous nation except a feeble remnant of about thirty families. Opposite the plain there was an island and a French fort, but there is now no appearance of either, the successive inundations having probably washed them away, as the willow island which is in the situation described by Du Pratz is small and of recent formation."

Mr. John Bradbury,‡ an English traveler who ascended the Missouri in 1811, says in his book under date of April 2, 1811: "We this day passed the site of a village on the northeast side of the river, once belonging to the Missouri tribe. Four miles above it are the remains of Fort Orleans, formerly belonging to the French. It is 240 miles from the mouth of the Missouri." There seems to be a discrepancy between the statements of Mr. Bradbury and those of Lewis and Clarke as to the remains of the fort. I do not believe that there could have been as late as 1811 any traces of its former existence visible, neither do I think it was located four miles above the village. Lewis and Clarke, following Du Pratz, expected to find the island on which it stood directly opposite the site of the village. Du Pratz was never up the Missouri, and had no personal knowledge of the position of the fort. I infer that he intended to convey the idea that the island was near the Missouris rather than directly opposite to them. About eight miles by the river course, down stream from the old village, there is now and has been ever since the country was surveyed by the Government, a large island, and on this I believe Fort Orleans was situated.

Mr. H. M. Breckenridge, § who ascended the Missouri river in 1811, gives in his journal a table of distances from the mouth of the Missouri, and at 236 miles he says: "Ancient village of the Missouri Indians, near which formerly stood Fort Orleans."

The foregoing extracts, I think, show conclusively that the Missouris were located about 240 miles up the Missouri river from its mouth, and that Fort Orleans was in their immediate vicinity. The erection of Fort Orleans has been ascribed by some writers || to the fears of the French awakened by the Spanish expedition of 1719, which was destroyed by the Missouris. This could not have been the cause. Information of that expedition did not reach New Orleans unti

*Lewis and Clarke, History of the Expedition to the Sources of the Missouri, etc. Paul Allen edition, vols.: Philadelphia, 1814.

†Now called Palmer's Creek, after a noted character in the early history of Grand River Valley, who onc resided near it.

‡Travels in the Interior of America, 1809, 1810, 1811, with a Description of Upper Louisiana. By Joh Bradbury: Liverpool, 1817.

§Views of Louisiana, with a Journal of a Voyage up the Missouri river in 1811. By H. M. Breckenridge Pittsburg, Pa., 1814.

||Notably Stoddard in his Sketches of Louisiana, published at Philadelphia in 1812, and whose ideas hav been copied by succeeding writers.

April, 1721, while the building of the fort was planned in France in 1719, executed the following year, and originated as follows:

The death of Louis XIV left France with an immense public debt, a legacy bequeathed by his military glory, and when the Duke of Orleans, in 1716, as Regent of France, found himself at the head of the Government, the financial situation of the empire had become desperate. The load of taxation required to merely pay the interest on the debt was overwhelming. In fact, the crisis was such that it was proposed in the Council of State to expunge the whole debt by an act of national bankruptcy. It was at this time when the wisest financiers were not able to see their way through the embarrassments of the treasury that John Law came forward with his panacea—the creation of a bank by which fictitious capital could be produced at will. His bank was chartered in 1716 as a private institution, but met with such success that it was changed in 1718 to the Royal Bank, of which he was named the Director-General. In the meantime other financial delusions in the shape of stock companies were inaugurated, and among them "The Western Company," afterward known as Law's Mississippi Scheme.* To this company the exclusive right to trade with Louisiana for twenty-five years was given, also the right of making grants of land, of levying troops, raising fortifications, appointing Governors of the colony and officers commanding the troops; in fact, they received almost sovereign powers over the entire Mississippi Valley.

Among its other privileges, the company was to be absolute owner of all the mines discovered, and great expectations were based on the revenues these undiscovered mines were to yield. The country of the Missouris was thought to be especially rich in lead and silver, and Capt. De Bourgmont, who had served several years in Canada and Louisiana, but was at this time residing in France, represented to the directory of the company that it would be advantageous to establish a fort on the Missouri river, near the tribe of Missouris, as in addition to the profit that could be derived from their trade, the knowledge of the country possessed by the Indians would be of great advantage to the company in their search for minerals.

The project was favorably entertained by the company, and De Bourgmont was authorized to proceed to the country of the Missouris and establish the post, of which he was to be the commandant. He proceeded at once to New Orleans, arriving there in 1720, and upon presenting his authority to Bienville, three boat-loads of provisions and other necessaries for the execution of his plan were furnished him. His military force consisted of thirty soldiers, two commissioned officers, and a sergeant named DuBois. To these were added several boatmen and Canadian voyagers, or *courier de bois*, together with some traders licensed by the company. They left New Orleans in the summer of 1720, and proceeded

*This branch of Law's financial schemes was of great benefit to Lonisiana. The resources of the country were advertised with the prodigality that characterized all of his undertakings. The press teemed with publications on the subject, while pamphlets setting forth the great advantages the country possessed were scattered broadcast. Hundreds were induced to go to Louisiana, and the result was that the colony received an impetus which it would have been long in gathering but for Law's Company.

directly to the country of the Missouris and were well received by the tribe. A palisade fort was erected, with a cabin for the officers and barracks for the soldiers and named Fort Orleans in honor of the Regent. During the year a proclama tion was issued throughout the colony of Louisiana informing the inhabitants tha they might obtain all the merchandise and provisions at cost from the stores of th company at Mobile and Dauphine Island, necessary to their wants, but if the had to be delivered at the Illinois and Missouri posts an addition of fifty per cent would be taxed.

De Bourgmont acted the part of a judicious commandant and establishe peace between the various Indian tribes inhabiting the country about him. In 1724 the Padoucahs,* in the west, still remained hostile, and to bring them int his confederacy he organized an expedition to their country. On the 25th of Jun of that year he dispatched a detachment of his command, under Ensign St. Ange to apprise the Padoucahs of his intended visit, and on the 3d of July followe them with twenty soldiers, one hundred Missouris and eighty-four Osages. Afte reaching the Kansas tribe his health failed him and he returned to Fort Orleans arriving there Aug. 5th. Sept. 25th he again set out and in due time reache the country of the Padoucahs, where he concluded a peace with that nation. On his return to Fort Orleans he was received by St. Ange, Sr., with a discharge o cannon and musketry, and upon entering the fort the Te Deum was sung i thankfulness for the happy result of the expedition.

The next year DeBourgmont, tiring of his wild life, arranged to return t France, and by telling wonderful stories of that country and distributing presents persuaded twelve Osages and Missouris to accompany him, among them th daughter of the great chief of the latter tribe. Embarking with these Indians some traders and a sergeant named DuBois, the commandant descended the Mi souri. Upon reaching the Mississippi a visit was made to Kaskaskia, wher Chicagou,† an Illinois chief, was persuaded to join the party. Descending th Mississippi they landed at New Orleans, where they rested a few days and the embarked for France.

Upon arriving in France they were presented at Court and were royally e tertained by the Mississippi Company. They then appeared in Paris‡ and dance Indian dances at the Italian Theater, and hunted a stag in the Bois de Boulogn by running. The chief's daughter embraced Christianity and was baptized Notre Dame, after which Sergeant DuBois married her, and in consequence of th alliance was made a captain and commandant of the Missouris. Great advan ages were expected to accrue to the company from the conversion of the Missou princess, as she was styled, and her marriage with Captain DuBois. She receiv presents from the ladies at Court, among others a fine gold watch, while tl warriors received blue coats trimmed with gold, and laced hats. The time arri

*Comanches.

†Son of the chief Chicagoes·eo mentioned by Marquette and LaSalle.

‡The London *Postman* of January, 1726 contains an account of the reception granted these Indians.

ing for their departure they set out well satisfied, and repairing to L'Orient, embarked for home. DeBourgmont remained in France and was rewarded for his great services to the company by being created a Knight of St. Louis.

Upon the arrival of Capt. DuBois and party, at New Orleans, they were grandly entertained at the expense of the company, which also furnished them with a boat and boatmen to take them to Fort Orleans, where they arrived in due course of time. There was great rejoicing among the Missouris to see their friends return, and especially to see them possessed of more treasures than they had before conceived of. Dances and games were inaugurated in the village and the friendship existing between the French and Missouris seemed to be more strongly cemented than ever. Mrs. DuBois lived at the fort with her husband, seemingly happy in having adopted the customs of the whites. Such was the condition of affairs when the boats that brought the party from New Orleans set out on their return. Early in the following spring some traders from Kaskaskia came up the river to trade with the Missouris, but on reaching their village found no evidence of Fort Orleans except its blackened ruins. It had been given to the flames, while the fate of its garrison had been the same as that of many other outposts. Had a single victim been spared he would have probably told the familiar story of treachery, surprise and massacre, ending in torture at the stake for those who unfortunately escaped the first onslaught. But not a single Frenchman was spared, and the history of the causes that led to the massacre, and the details of its execution will for ever remain unwritten. Madam DuBois was found by the traders to be living with her own people, having renounced Christianity and resumed the manners and customs of her people. She has been thought by some to have been in some way connected with the massacre. Several years later she married a captain in the French service, named Marin, and in 1751 a daughter by this marriage was living at Kaskaskia. Fort Orleans was the first and last French post in the country of the Missouris.

BIOLOGY.

MIVART ON THE CAT.

The great advances that have been made in biology—the science which treats of all living organisms from man to the lowest plant—and the important changes that have been wrought in men's minds in consequence, have impressed Dr. Mivart with the conviction that the natural history of animals and plants needs to be rewritten, and the field of nature surveyed from a new stand-point. In the preparation of such a history two ways were open—either to begin with the lowliest and most simply organized of living creatures, and gradually ascend to

the highest and most complex in structure, or to begin with the latter, and from thence descend to the consideration of the lowest kinds of animated beings. Dr. Mivart gives the preference to the last-named course, and deviating in its execution from the historical practice of beginning the study of animals and plants with man, as the type of the highest class, for various reasons, which he states with great cogency, has preferred to select for examination and comparison some other animal, easily obtained, of convenient size, belonging to man's class—that of mammals—and not so different from him in the structure of its limbs and other large portions of its frame but that analogies between it and him may readily suggest themselves. He has selected the common cat as most fully satisfying these conditions, and in an exhaustive treatise, which he entitles "The Cat," and which he intends as an introduction to the natural history of the entire group of backboned animals, as well as to zoölogy generally and to biology, he presents the results of his elaborate study of the zoölogy of the cat, treating the subject so as to give the student of biology such a knowledge of anatomy, physiology, and the kindred sciences as may enable him to study profitably the whole class to which it belongs.

Concluding that the study of the anatomy and physiology of the cat might be best pursued by investigating the function of each organ and set of organs, and their structure, in the performance of his task Dr. Mivart has treated of these in successive chapters, in the following order: the skeleton, the muscles, the organs of alimentation, of circulation, of respiration and secretion, of generation and reproduction, the nervous system and the organs of sense, the development of the body, and psychology. Having thus disposed of the facts of structure and formation, he then proceeds to consider the various affinities of the cat to other animals (in this chapter including a full and interesting account of all the different kinds of cat, wild and domesticated), and its relations to space and time, or, in other words, its place in nature. In following out this plan, Dr. Mivart treats elaborately upon the anatomy, physiology, psychology, taxonomy, and hexicology of the cat, unfolding the processes of individual development, or the series of changes gone through by each individual of the cat species in reaching maturity; and in a concluding chapter he considers the development of the species, and gives his conclusions as to the pedigree and origin, both of the ca considered as a species and of the whole family of Felidæ. In arriving at hi conclusions on this head he rejects as a crude and inadequate conception th theory that the origin of species is due to natural selection, and maintains that th genesis of new species is due mainly to an internal cause, which may be stimulat ed or aided, or may be more or less restricted, by the action of surrounding cor ditions; that all our knowledge being derived from experience, we can only judg (apart from revelation) of things as they have been by things as they are; that a every animal is now the product of a parent organism more or less like it, so an antecedent animal also was the product of a parent organism more or less like it that we do daily see the origin of concrete embodiments of ideas which are no

only as distinct as one species from another, but are distinct as genera, families, orders, classes, and even kingdoms; that according to our present experience any new specific form would make its appearance during the period of embryonic life, and that such variations are capable of being transmitted to the offspring of the animals in which they first arise; that at various stages of individual evolution, sudden changes, caused by an acceleration or by an arrest of the development process, or even by some retogressive action, may have resulted not merely in the production in the còncrete of new species, but even for a new genus, family or order; that the changes of development in all animals and plants are not carried on by a fortuitous concourse of influences, or by minute hap-hazard variations in all directions, but by a definite system of internal law, aided and influenced in the past as now by the action of incident forces operating according to law, and resulting in due and orderly *specific genesis*; that in the process of evolution we have constant evidence of a Great First Cause, ever and always operating throughout nature in a manner hidden from the eye of sense, but clearly manifested to the intellectual vision; that a belief in evolution, far from leading to a denial of "creation," distinctly affirms it, and that a candid study of merely organic life makes evident the logical need which exists for the Theistic conception.—*Harper's Monthly for July, 1881.*

RELATIONS OF SCIENCE TO SPECULATION.

PRINCIPAL J. W. DAWSON, LL. D.

"Do we really exist? If we do, what is the thing called life?" Such are the problems that were discussed by Principal Dawson, of Montreal, a Fellow of the Royal Society and one of the best living scientists in the study of biology, in his lecture at Association hall, Philadelphia. It was the first of a series of gratuitous Lectures on "The Relations of Natural Science to Monastic and Agnostic Speculations," given under the auspices of the Crozier Theological Seminary.

If we ask, said the lecturer, what is science in relation to nature, we have before us all that men have observed of the workings and objects of nature and the deductions therefrom. But added to this is something of another sort, sometimes called philosophy, which is really a mass of material, the growth of the thoughts of the times, and this is that troublesome commodity—modern speculation. Evolutionists need the less complain of this view, as it is the natural outgrowth of their theory. It by no means follows that our knowledge of recent discoveries equals the extent of their practical application. Take, for instance, electricity. Its application in a variety of ways is almost general, and yet there are very few things we know less about, either as to its laws or by what it is regulated. There is so much discovery that men are in danger of thinking themselves omniscient, but in reality the most of the accomplishments of science remain mysteries to mankind. The tendancy to mad specialties of study, too,

causes a great deal of general speculation, covering the whole field to be made, from a point of view that is really restricted. Then there has sprung up a demand for sensational science just as there has sprung up a demand for sensational fiction, and if it cannot be met by facts in existence, something has to be invented, for the number of half starved scientific men who are trying to find the secrets of nature is by no means small. Moreover a great deal of supposed scientific truth is vague and does not mean one-half what is supposed. I don't know to what extent science is to be blamed, but not a few of those who have pushed speculation to its utmost have been literary men, and some of them had studied theology as well. An agnostic, you know, is literally one who doesn't know. As one of them has expressed the idea, "the existence of a God is unthinkable." The agnostic, while saying less than the atheist, means scientifically more, and steels himself against argument by saying it cannot be reasoned about at all. In the true sense no scientific man can be an agnostic. There are few of us, perhaps, who will refuse to accept the creed, "I exist," although there are some who might limit it, and yet our personal existence is a thing most incomprehensible, especially in regard to its beginning and its ending.

We are in a boundless space and time, with the beginning of either a mystery, so that it is scarcely possible for any one to admit their own existence without arousing a vestige of the religious idea. In personal existence is involved the question whether or not the vastly complex bodily organism is the first or only the outer shell. We cannot but admit that the body is vastly more mysterious since science took it up, There is a class of philosophers who think it will simplify matters to consider the individual as a material substance with two sets of properties. If by a material substance is meant a combination of elements there is no such material in existence having the qualities of mind; if it means the whole being, the statement amounts to nothing. We must admit there is something more and that is life. Nutrition, reproduction, sensation and voluntary motion are it functions, the last two being restricted to animal life. Herbert Spencer says lif is "the continuous adjustment of internal and external relations," but that is ver vague and only touches the surface. I think myself that life has the same rela tion to organisms that force has to matter. It is some energy, whether a comb nation of physical energies, or the same but correlated only with organization It is all very well to find fault with calling the living organization "a machine, but a machine has to be made by some one and for a purpose, and there is a enormous lot of theism in the idea. Who ever heard of a machine made by n body for nothing in particular? What is the use in talking about protoplasm as th basis of life when in point of fact protoplasm depends on life as its basis? A the white of an egg is protoplasm, but life is in the embryo cell. Protoplasm ma go to make feathers and flesh and tissue, and yet the life that constitutes th chick may be elsewhere. Going further, science fails to correlate the power the human will with any physical force. It is an energy that operates only c living organs and through them on other things. Then comes the question, a

we the originators of the world, or did it produce us, or is there a great third Being? If an atom is a vortex, as they say, what is it a vortex of? We talk very learnedly of laws of nature, but they are but the expressions of the controlled motion of things. Behind them lies an insoluble mystery.

In conclusion Mr. Dawson discussed the three theories of Herbert Spencer as to the origin of things "self-existing" or "self-created" or "created by external agency," and raised a laugh by saying that the possibility of creation by an agency within had never occurred to Mr. Spencer. Mr. Dawson's deduction was that science is not inconsistent with the view of a superhuman power as explaining the origin, design and continuance of things.—*Philadelphia Times.*

MEDICINE AND HYGIENE.

COMMON SENSE SANITATION.

THEO. S. CASE, KANSAS CITY.

The difficulty of securing the proper healthfulness of cities and dwellings seems to be that the people have come to regard sanitation a "scientific" matter, to be conceived and projected only by doctors and engineers and to be executed oniy by expensive and predaceous plumbers, by means of labyrinthine and imperfect pipes and illusory ventilatros, which are prone to perverse and baneful misdirection of their contents.

The idea of "dirt" is obscured and over-slaughed by technical terms like "fever germs," "bacteria," "pollution," "sewer gas," etc, until the ordinary citizen is appalled and led to regard the washing of his face or the cleansing of his cistern as the feeblest and most useless of defenses against enemies so mighty and omnipresent.

When, however, we come to examine the most perfect systems of sanitation for cities, the gigantic developments of sanitary engineering in the metropolitan cities of London, New York, etc., combined with the most modern hygienic improvements in the building of houses and the treatment of the human body, we find that the success of the whole structure depends upon

1. Personal cleanliness.
2. Household cleanliness.
3. Municipal cleanliness.

All the legislation conceivable will be of no service in preserving the health of a city unless the first of these is observed, and it is there that the work should commence.

Free baths, with whatever of compulsion is necessary to make that class of

citizens use them who need them most and which class is most averse to their use, are of the first importance. Bodily cleanliness is the first step toward household neatness, for no clean family will live in a filthy house. It is this feeling, combined with the natural alarm produced by the frightful pictures and objects drawn by sanitary engineers and microscopists, that has led the people of great cities to grasp at any straw that promised relief or escape from the dangers of the specter *unsanitaries*. It has driven them from the common sense measures that would have in most cases answered every purpose, to the transfer of the personal control of their own households to municipal officers whose blundering and jobbery has inflicted great burdens of taxation as well as many physical evils upon them.

The cleansing of dwellings does not depend alone upon the use of water. Dry dirt is preferable to moist and moldy cleanliness. Scrubbing is good sanitation only when followed by thorough drying and ventilation. Dry dirt, even on a kitchen floor, is far more tolerable, hygienically than slops and rotten beams under the floor. Moist and mildewed papers, held to sodden walls by putrid paste, will originate diseases which could have no existence in a dry atmosphere. These evils are not remedied by sewer pipes. On the contrary they are often intensified by the addition of sewer gases escaping from defective joints. The remedy is to properly carry off from the roofs the rain which otherwise permeates the walls, and to put down kitchen floors that are impermeable to water. These precautions, with proper ventilation, will go far to render our dwellings dry and healthful.

To properly cleanse streets and alleys is to remove the filth, not by washing it partially away occasionally with a hose and leaving the remainder to ferment and fester in the sun in the nooks and corners, the interstices between the flags o the gutters, and in the mud of the macadam, but by scraping and sweeping it up and carting it away, by leaving the streets as dry as may be except from the most superficial sprinkling, by removing all slops and garbage from the alley and using lime and copperas as disinfectants at all offensive localities.

A model street is one composed of a smooth, not slippery, hard material, impermeable to moisture; with its sewers opening into towers high enough to discharge the foul gases above the heads of the people and its dust and accumulations swept or washed away at night.

Much of the pestilence which has decimated Memphis twice within the past few years was due to the condition of her streets, which had been covered with wooden pavements. "These had become much decayed, and readily absorbed much of the liquid filth that flowed over the rotten gutters, and in due course became so permeated with it that the periodical flushings of rain storms utterly failed to cleanse them and they were the constant source of poisonous emanations."

The disposition of the sewage of a town is the most troublesome question of all, and one that is far from being settled, though millions of dollars have been expended in the large cities of the world, in attempts to solve it. Manifestly the most complete and thorough solution of the matter is to burn the solid portion

the next is to bury it in the ground, and the last to discharge it through sewers into the nearest water course. The first is the most expensive, though clearly the only perfect destruction of it; the second, though a natural rendering of "earth to earth," will only answer in districts comparatively sparsely settled, while the last is that best adapted to the conveniences of most cities, though by no means satisfactory in a hygienic sense.

In London, after the Thames river had become an intolerable nuisance by reason of its filthiness as a scavenger of the immense city, the removal of the sewage was handed over to the Metropolitan Board of Works. The general plan adopted was that of intercepting sewers, which receive and convey the entire mass to out falls far below the city where it is discharged, twice every twenty-four hours, from immense reservoirs, upon the flood tide and, theoretically at least, borne out to sea. At Edinburgh where the natural facilities for its disposition are far better, the sewage and rainfall are discharged at the conveniently near sea outlet at Portobello. At Glasgow, the sewage is emptied into the Clyde, and later, the foul mud of that stream is dredged up and conveyed in barges to a deep Loch more than twenty-five miles off.

In New York and Boston the most serious trouble has been experienced from the same causes, and gigantic engineering enterprises are being considered and adopted for the relief of the people from the effects of pouring such vast amounts of sewage into the streams and bays near those cities. To show how the presence of such matters affects the health of the localities, where they are exposed, it is only necessary to refer to the case of Glasgow, where the sewage, though deposited in a wide and deep Loch out in the country, has engendered new types of disease and converted one of the healthiest seaside resorts into a pestilential ever center. In this city our only practicable resort is to deliver our sewage into ntercepting sewers which shall conduct it to the Missouri river, at a proper disance below the city. Fortunately its rapid current is our sure safeguard against ny possible return of it to afflict us with its evils. The main thing to guard gainst then, is ill-constructed, ill fitting, leaky pipes, through which the deadly ewer gas escapes and, penetrating our houses, poisons our families.

When a respectable householder, in his anxiety to avail himself of every neans of making his home pleasant and healthful, connects it with a main sewer e runs a risk beside which exposure to small-pox is a trifle. He places himself t the upper end of a tube, which, if defectively valved and trapped, leads into his ouse, by natural laws, gases, which, evolved from the outpourings of hospitals, soap ctories, slaughter houses, hotels and dwellings, are unutterably foul and maligant. Common sense says, keep such pipes out of your houses, or if you cannot o so in cities, then see to it that the connections are made by conscientious exerts who understand the dangers and their prevention, and that the main sewers e fully ventilated, and in such a way as not to force them into our dwellings, or discharge their offensive effluvia at our prominent street corners in the faces f our wives and children as they pass by.

London suffers immeasurably from the pent-up sewer gas, which, under its system of collection and storage, inevitably accumulates in the reservoirs and pipes, and pushes its way with overpowering force through almost every obstacle presented by engineers and plumbers, so that the problem of rendering a dwelling house proof against it is one of no easy solution.

Mr. Geo. E. Waring, the well known sanitary engineer, proposes separate conductors or sewers for the removal of the natural or land and surface waters, and for the removal of the artificial or house and soil drainage of cities. He also recommends the system of "pipe drainage" now in use at Memphis, the leading principles being "the restriction of the size of the sewers to a capacity barely sufficient to carry the greatest flow of the day when running half-full; the most complete and thorough ventilation of every part of the sewer; and its thorough washing, from end to end, at least once in twenty-four hours, by a suddenly discharged volume of clean water sufficient to carry forward, at least to a point where the constant flow is sufficient to keep them in motion, all solid substances delivered to the sewer by its tributary house drains, so that nothing of a putrescible character shall remain in the sewer long enough for its decomposition even to begin." This plan has succeeded admirably in Memphis, entirely preventing the formation of sewer gas in the pipes, even in the hottest weather.

In Baltimore all of the rainfall is removed by surface gutters, the experience of the people having demonstrated effectually the importance of retaining it upon the streets for cleansing purposes. The same plan might prove effectual in Kansas City, if our streets were properly paved, since the topography of the two cities is somewhat similar and our spring and summer rains are so copious as to insure perfect cleansing with every shower.

We are then fortunately able to adopt the Memphis plan for our sewers and house drains, and the Baltimore plan for the removal of the clean surface water or rainfall, with the beneficial effect of washing off our streets at the same time.

All this is common sense sanitation, and if such simple plans as these are adopted for the personal, household and municipal cleanliness of our city there need be little fear of pestilence.

INSTINCT AS A GUIDE IN DIETETICS.

"Instinct," as Falstaff says, "is a great matter;" and it is curious and instructive to note how, in the absence of scientific knowledge, it has guided the human race in the selection and preparation of their food as well as such knowledge could have guided them, and in some cases even better. It has sometimes been right when science for the time was wrong, and the latter has eventually had to acknowledge the mistake it had made. It is not many years since the discovery was announced that the bran of wheat had a high nutritive value, and forthwith we were admonished by dietetic reformers that fine wheaten bread wa

not an economical food for the workingman. But that unscientific personage had learned to prefer the fine white loaf to the coarse brown one, and declined to be a convert to the new theory. His scientific brother naturally ascribed this to the force of habit or prejudice, and was very severe upon the obstinate wastefulness of the poor in throwing away an important part of their scanty fare. But, as we now know, the instinct that led the workingman to stick to the bread which the experience of many generations had taught him to prefer was right in its choice. The brown bread did, indeed, contain more nutriment than the white, but in the process of digestion the body got more nutriment from the latter than the former, The action of the bran particles on the alimentary canal caused the coarse bread to pass through it too rapidly, and the loss in this way was greater than the gain in the other. Improved processes now furnish us a fine flour in which the old waste of nutritious material is largely prevented; but even under the old methods of milling, the notion that "white bread is the poor man's food" was correct. It was brown bread that was the luxury, suited to the dyspeptic rich man, but too dear for the healthy and hard-working poor. Science was too hasty in its first inferences, and has since learned that the digestibility of food and its aptitude for assimilation must be considered, and not merely its chemical composition.

Equally based upon sound principles is the working man's liking for animal food. Scientific men have demonstrated that vegetable food contains essentially the same nutritive matter, while it is a good deal cheaper. They have explained that the fibrine of flesh has a very close analogy to the gluten of wheat, and is fitted to serve the same purpose in nourishing the body, and so with animal fats and vegetable oils and the other leading constituents of the two kinds of diet; but the poor man nevertheless persists in spending as much of his hard earnings for meat as he can possibly afford. If he cannot have the coveted food every day, he will have it when he can, if only once a week. Recent German investigations prove that this preference for flesh has somewhat the same economical arguments in its favor as that for the fine bread in comparison with the coarse. It has long been known that, as a general rule, flesh is easier of digestion, and is therefore more perfectly assimilated, than bread and other vegetable food. We must consider not merely how much nutriment each puts into the body, but how much of it remains there and how much is rejected as waste. Good authorities have stated that, if equal nutritive quantities of each are eaten, the loss from the vegetable is twice as much as from the animal food; but it would seem from these recent experiments and analyses that the waste of nutriment is often much greater in the case of vegetables.

Professor Hofmann gave to a servant of his 1000 grams of potatoes, 207 grams of lentils, and 40 grams of bread. On an average of six days it was found that 356 grams of the solid matter were digested, 116 remaining undigested; 38.7 of nitrogenous matter had been digested, 44.4 undigested; 263.7 of starch digested, and 28.2 not. It would here appear that not even one-half of the total albuminous matter of this vegetable diet had been digested.

The same man was then given 390 grams of lean beef daily, 126 of pure fat, and 40 grams of flour. The result was that 221.8 grams of solid matter were digested, 33.6 undigested; 73 of albuminous matter were digested, and 16.9 undigested; 121.1 of fat were digested, and 4.9 undigested. Here the animal food was shown to be much more digestible than the vegetable.

Dr. C. Meineret, in a recent treatise, gives the loss of nitrogen in solid excreta expressed in percentages of the total nitrogen contained in various substances. In meat that loss he found to be only 2.6; in egg 2.6; in milk and cheese together, 2.9 to 4 9; in milk alone, 7; in macaroni, 17.1; in peas, 27.8; in black bread, 32; in potatoes, 32; in carrots, 39; in lentils, potatoes and bread taken together, 47; in lentils, 40.2; in celery, cabbage, and carrots, 21; in Horsford-Liebig's bread, 32.40; in rye bread, 22.2; in very black (or brown) bread, 42.3; in white wheaten bread, 19.9; in mixed food with meat (fourteen days), 18 to 12. White bread, it will be noticed, is far more digestible than brown bread.

Rubner took 1172 and 1435 grams of meat daily (more than 2 lbs.), and yet all the albuminous matter except 2.5 per cent. was digested; and when 21 eggs were taken daily, 2.9 per cent. alone of the albumen was undigested. Flügge took daily one liter of milk, 500 grams of meat, 150 grams of wheaten bread, and 68 grams of butter, and found that 94 per cent. of the nitrogen was absorbed, and 95 per cent. of the fat. When he took a diet chiefly vegetable, he had only 85.3 per cent. of the nitrogen absorbed, and 88.7 per cent. of the fat.

The results of these experiments by independent investigators evidently agree in proving that a much larger fraction of nutriment is utilized in the case of the animal than in that of the vegetable food. They go far toward knocking away the very foundations of vegetarianism by showing that our digestive apparatus is better adapted to deal with the former than the latter; and they strongly confirm the teachings of an instinct of the race on this subject.—*Boston Journal of Chemistry.*

CHEMISTRY.

ATMOSPHERIC OZONE.

PROF. G. H. FAILYER, MANHATTAN, KANSAS.

A favorite study, which has suddenly come to naught, is upon the occurrence of ozone in the atmosphere. Much painstaking labor has been expended in noting the variations of ozone in the air between day and night, different seasons, climates, and sections. An incentive to these labors existed in the supposed relation of ozone to vegetable nutrition and to the health of man. Ozone, being an energetic oxidizer, would form assimilable compounds of nitrogen, to nourish

plants; and if plants emit ozone, as is believed by some agricultural chemists, they would have within themselves the power to partially supply the nitrogen which they require. The large leafed plants, according to this view, should be better able to supply themselves with these needed compounds; and, seemingly to substantiate this view, it has been observed in agricultural practice that these same plants, with massive foliage, although they contain a larger amount of nitrogen, do not impoverish the soil as do the fine-leafed cereals. Further, the presence in the atmosphere of such a vigorous oxidizing agent would destroy such organic matters as prevade the air; and epidemic diseases would be rarer, in proportion as the ozone increased in the air. But, being irrespirable from its great activity, throat diseases would proportionately increase.

These considerations were sufficient to direct the greatest attention to atmospheric conditions in this respect. The usual test for ozone in the air has been the well-known iodide-of-potassium starch-papers. The ozone oxidizes the potassium and sets free the iodine, which then reacts upon the starch, giving a blue which varies in intensity with the proportion of ozone present. This color is compared with a scale of varying tints, and the corresponding number read off. It was known that other substances, such as nitrous acid and hydric-peroxide, have the power to thus react with this test; and that ozone would act only in the presence of moisture. The influence of the latter seems not to have been given its true importance. The former objection was met by the fact that peroxide of hydrogen was not known to exist in the air, even in minute quantity; and it was supposed to have been demonstrated that it gives the reaction only when concentrated. The papers were blued under conditions when it could not have been due to nitrous acid. But later and more satisfactory investigations have shown that hydric superoxide does exist in the air, and that in sufficient quantity to react with the above test. The reliability of this test for estimating any oxidizing principle in the atmosphere, has been shown by observing that the hygroscopic character of the paper used, although the same formula be followed in preparing the reagent, so far influences the reaction that test papers from different sources, exposed together, give widely different results. The results with the same paper vary with the humidity, and seem to have little other value than is possessed in common by crude chemical hygrometers. Nor are the other tests which have hitherto been trusted, decisive between ozone and these other oxidizers. So that the existence of ozone as a usual constituent of the atmosphere, has been rendered quite problematical. Thallium papers, however, are not influenced by moisture, and seem to furnish a reliable means of estimating the oxidizing principle present in the air; and it seems, in general, to be peroxide of hydrogen.

Do these uncertainties regarding the existence of ozone in the atmosphere, overthrow all the conclusions drawn from its supposed abundance? Does the untrustworthiness of the conclusions based upon carefully conducted experiments show the folly of trusting scientific "facts" and of accepting the theories founded upon them? To the latter the answer is an emphatic no; to the former, in one

sense, it may be, yes; in another, it must be, no. In the first place, while the proportion of the oxidizing agent, as determined by the iodide-of potassium-starch-papers, is of no value whatever, and we do not know that ozone is ever found in the mass of the atmosphere, the existence of some oxidizing agent is not, and cannot be, questioned. And, whether the action upon the thallium or other test papers be due to one or several of these agents, from a practical standpoint would not seem to be so important as the fact that the oxidizers exist, and do purify the air by consuming the effluvia and other noxious substances that find their way into it. Nor are we to lose faith in the conclusions and theories of scientists because occasionally these conclusions are based upon inadequate knowledge.

The scientific mind of the world is the embodiment of the known facts of nature. When a series of facts, learned by observation or experiment, show the same thing, this scientific opinion is in accordance with them. When it is learned that other principles are involved than those previously known, without a protest, this opinion is founded upon the new facts. While a few scientific men, from association, find it difficult to give up long cherished views, no class of men are so little dogmatic as they. Even the same individuals may hold tenaciously to other faiths, whether political, religious, or socialistic, while in natural science he adjusts his belief in accordance with the light he has.

We claim it as the chief reason for trusting scientific opinion, that a vast corps of trained workers are constantly testing from every point of view the various principles upon which all theories and rules of action are based; and so soon as a single fact inconsistent with an accepted principle is found, the principle and all views and practices due to it, are discarded.

The question of the existence or non existence of ozone in the atmosphere, which just now is in doubt because of the lack of proper tests, was previously answered in the affirmative; and the answer was a purely chemical one, involving chemical reactions. And yet no one will doubt that pure chemistry gives to man the most trustworthy evidence in his possession.—*The Industrialist.*

ASTRONOMY.

ASTRONOMICAL NOTES FOR JULY, 1881.

BY W. W. ALEXANDER, KANSAS CITY.

MERCURY, from the 1st to the 17th, will be among the stars in Cancer, and the remainder of the month in Gemini. There will be no favorable time this month for observing it. On the 17th it is in inferior conjunction with the sun.

VENUS will be in a favorable position during the entire month for observation. On the 12th it reaches its greatest elongation west from the sun, 45° 44′.

At that time, if observed with a good telescope, it will appear in the same form as the Moon does at first or last quarters, the terminator being straight and cutting the disk into equal semi-circles. For the month it will be in the constellation Taurus. On the morning of the 13th a line drawn from Aldebaran to the Pleiades will pass through this planet, it being near Hind's variable nebula. On the 30th it will be in the Milky Way, near Chacornac's variable nebula. It is receding from the earth during the entire month, its apparent diameter on 1st being 72″ and on the 31st 20″.

MARS, from the 1st to the 23d, will be in Aries, and the rest of the month in Taurus. On the 6th it is in conjunction with Saturn, being north 1° 5′. On the 14th it is 33′ north of Neptune. On the morning of the 22d it will be in close conjunction with Jupiter, being only 7′ or a little less than one-fourth the apparent diameter of the Moon, south of that planet. Its apparent diameter is slowly increasing, being 6.64″ on the 1st and 7.35″ on the 31st. It rises a little after midnight.

JUPITER, with its four satellites, will adorn the eastern sky, rising about 5 hours before the Sun. It will be in the constellation Aries. Its apparent Right Ascension on the 1st is 3 hours 4 minutes, and on the 31st 3 hours 23 minutes. Its apparent diameter is 34″ on the 1st, and 37″ on the 31st. The satellites present but few phenomena of interest, except on the morning of the 16th, when the third will disappear in eclipse at 2 hours, 33 minutes, 55 seconds.

SATURN rises about midnight—a little before Jupiter. Its position is favorable for morning observers. The Earth on the 18th is elevated above the plane of the southern surface of its ring 20°. This remarkable planet is at a mean distance of 872,135,000 miles from the sun. It performs a revolution around that orb in 10759.2 mean solar days. Its volume is 746.9 times that of the earth. This planet, belted like Jupiter, is surrounded not only by eight moons, but by a succession of rings that extend out in the plane of its equator 83,000 miles, the inner one being transparent. The equator of this planet, unlike that of Jupiter, is inclined 26° 48′ to the ecliptic; hence transits, eclipses and occultations of its satellites, the orbits of which for the most part lie in the plane of the equator, occur but rarely. It is the rings that form the most attractive part of this planet's phenomena. We may imagine how much earlier observers (with their imperfect telescopes) were puzzled by these strange appendages. It was at first supposed to resemble a vase, so the name of Ansæ, or handles, were given to the rings in certain positions by many observers. By some it was supposed to consist of three bodies, the larger one in the middle. The true nature of the ring was first discovered by Huyghens, in 1655. Nothing in the history of astronomy is more encouraging than the way in which eye and mind have spanned the tremendous distance which separates us from this planet. The fact that the appearance was caused by a ring was first determined by Huyghens; then a separation dividing the ring into two was observed. The extreme thinness of the rings was noted by Sir William Herschel, when he saw the satellites like pearls on a silver thread.

An American astronomer finally ascertained that the number of the rings must be increased many fold. Next followed the discovery of the transparent ring in 1852. Then this ring was found to be multiple. It is now known that the divisions in the various rings are subject to change, and that the whole system is probably increasing in breadth and approaching the planet. Of what, then, are these rings composed? The more plausible theory is that they are composed of myriads of satellites or small bodies, moving each in its own orbit round the planet, causing the appearance of a bright ring where they are close together, and a faint one where more scattered. This theory accounts for the varying brightness of its different parts, and its haziness near the planet.

URANUS will be in the constellation Leo. On the 18th it is 12° 30′ east and 4° 30′ south of Regulus, the brightest star in this constellation. Its apparent diameter on the 1st is 3.58″ and on the 31st 3.50″.

NEPTUNE on the 15th will be in the constellation Aries, in Right Ascension 2 hours 57 minutes, and Declination 15° 1′ north.. This position is nearly correct for the entire month.

THE MOON on the 1st will be in conjunction with Uranus. On the morning of the 20th it will pass north of Jupiter, Mars and Neptune, about 3° 30′.

CABLING OF ASTRONOMICAL INTELLIGENCE.

The question of transmission of astronomical announcements and intelligence has recently caused a considerable amount of discussion among European astronomical societies, the members of which had come to the conclusion that the system formerly in use was unreliable and the cause of much trouble to the possessors of large telescopes, which require tolerably exact positions to easily obtain good results. So much trouble has there been on this account, that the possessors of large instrumeuts, as a rule, do not care to attempt to observe comets unless a finding ephemeris can be prepared for their use, and to facilitate their observations, it has been the custom for some time, in Germany, England and this country, to circulate these data by mail so soon as they can be prepared.

It has often so happened that the prevalence of storms, or the immediate following of the discovery of the comet by a bright and increasing moonlight, has caused the total loss of a comet, so far as observations are concerned, while confusion and annoyance were of quite frequent occurrence.

With the idea of adopting a system of announcement of astronomical discovery and data, which should be as free as possible from error of any kind, a correspondence was last year maintained among European astronomers, and a system was decided upon which seemed reasonably free from possible error. By this system the name of the discoverer of a comet, date, position of it, and motion, were to be comprised in a cable message of sixteen or eighteen words. Nothing was attempted in the way of transmitting further intelligence, and the liability of

there being no observation of a comet throughout an entire continent was still very possible.

To obviate this difficulty, Messrs. S. C. Chandler, jr., and John Ritchie, jr., of the *Boston Scientific Society*, have adapted a telegraphic code to the needs of astronomy, and a first test of this code has just been made over the Atlantic cable. The entire elements and ephemeris covering sixteen days have been successfully sent across the ocean—those data computed at Boston being sent to the private observatory of Lord Crawford, at Dun Echt, Scotland, and those computed at Dun Echt have been successfully sent to Boston; Boston and Dun Echt being respectively the comet circular centres of the United States and England respectively.

The positions on which the Boston elements were based covered the unusually short period of three days; and had one of these positions been doubtful, or had the storm which has just passed across the country been but an hour earlier in reaching Portland, Me., where the American position of May 5th was obtained, the probabilities are that from American data alone an ephemeris could not have been issued for more than a week after the time that it was actually circulated—a considerable loss in the matter of actual observation Had this happened, American astronomers could have depended upon European data, which were published in a Special Circular of the *Science Observer* but a day later than their own Boston calculations, and the same adverse circumstances that have a number of times caused such trouble and disappointment, would have had no effect.

The system adapted by Messrs. Chandler and Ritchie is more complete in the data given, self-checking and less liable to error, and a complete set of elements, together with an ephemeris of four dates, together with the light curve, are comprised in a message of *sixteen* words. By the same system the telegraph announcement can be made of the discovery of a comet in only seven words, in place of sixteen by the system now in use, and should two of these seven words be absolutely lost, there would still be sufficient data to render the finding of the comet no more difficult than it now is in general with the data given by the sixteen words of the system now in use.

The successful result of the experiments with this code may be considered as a long step onward in practical astronomy.

An Alabama man announces that he does not believe the world rotates. He says: "When two objects pass each other, going in opposite directions, they pass very quickly, as, for instance, a bird flying west ought to pass objects upon the earth much more rapidly than when it flies east. But this is not the case. A bird passes no more rapidly going west than when it flies east; a ball thrown against a house in a westerly direction does not rebound any more than when thrown east. You may send a balloon up above your head and let it stand twenty-four hours, and at the expiration of the twenty-four hours the balloon will be directly over your head. I have studied the reasons given in astronomy, and find nothing to refute my observations."

METEOROLOGY.

A REMARKABLE SPELL OF WEATHER—JUNE 9TH TO 12TH, 1881.

The storms of June 9th to 12th, 1881, were so severe and widespread through the West that we have deemed it worth while to record them, merely as a matter of history, leaving the meteorologists to work up the causes and the laws that produced and directed them.—[Ed.

THURSDAY, JUNE 9TH.

An unusually severe hail and wind storm occurred in the vicinity of Solomon City, in Dickinson county, on the Kansas Division of the Union Pacific Railroad. Hailstones fell in great quantities and of large size, some of them measuring ten inches in circumference. The storm extended over a strip of fine farming country, about four miles wide aud six long, the direction being from the northwest to the southeast in this district. A correspondent at Solomon City furnishes the following account of the storm: "At about 4 o'clock in the afternoon the clouds began to gather in the north and west, and to circle about and take on changing positions rapidly. At half past 4 a small sharp point was seen to drop down slowly three miles northwest of here till it struck the ground, and the column continued sinking till at the base in contact with the earth it measured something like forty rods across, and widening gradually into a most magnificent inverted cone, started slowly, moving to the north and east, and was watched with intense interest from this point till it passed out of sight. At 6 o'clock the wind began to change here in a most fitful manner, blowing a gale from every point of the compas within the space of ten minutes. Then great chunks of ice began to fall with a force that was more fearful than can be described, crushing through windows, cutting the leaves and small branches from the trees and pounding the crops into the ground. No one who witnessed ever saw or heard anything that equaled it.

There were two or three different storm clouds of more or less power, some of them moving in one direction and some in another, but the main one, the one which claimed for its own everything within the scope of its size, took northeasterly for its general direction. The storm commenced at a point a few miles north of Salina and from the first everything it touched was doomed. Moving on, sometimes with steady stride, it would cut a clean swath, and anon it would leap up and forward and a space would be left entirely undamaged. Then again it would strike the earth with redoubled fury, tearing up the very ground in its insatiate greed of spoil. One gentleman lost a reaper and can find no trace of it; another had a new header taken off and not a vestige of it has been found up to this time. Machinery of every description standing in the fields was broken and twisted till worthless, and entire fields of grain were taken, leaving the ground as

clean and bare as though just plowed and rolled. Striking the Solomon river at a point about four miles west of here, it left indelible traces of its visit. Huge trees of every variety were torn and twisted as though they were but saplings, and the limbs strewn for more than half a mile over the prairie, while the greater portion of them were denuded of bark as entirely as though stripped with a woodman's ax. One elm, noticed especially, was torn from its hold upon the earth and carried from its position nearly twenty yards, while some of its limbs were found over a quarter of a mile distant. The tree measured two and one-half feet through, and the spread of its roots, as it lay prone upon the ground, was ten feet. The cavity left where it had stood would have buried a fair sized house. Other immense trees were torn from the bank and hurled into the river, while one and all were broken as easily as though formed from potter's clay. Mud was scattered in profusion over the course of its track and thrown against stumps of trees with such force as to pack it as though pressed by powerful machinery.

About eighty rods from the river stood a strong log house, owned by Mr. Peter Sullivan. He had the misfortune last Sabbath to have a team run away with him, thereby receiving a fractured leg. He was lying in bed in his house and a number of friends had called upon him, so that eight persons were congregated in the house at the time of the storm. The place was not in the direct line marked out for destruction, but was, so to speak, a side issue. The house was built of hewn logs, a story and a half in height. The logs were about twenty-five feet in length, one and one half feet wide and about ten inches thick. They were dovetailed together at the end, and it seemed as though the house might stand for ages, but one breath of the monster razed it to the ground, or more properly speaking, to the floor, and I saw one of the logs forty yards from the house. Nothing but the floor and one or two logs remained to mark the place where once it stood; but the strangest part of the story is, that not one of the eight persons in the house at the time was injured in the least. It stripped the bed, on which Mr. Sullivan was lying, of its clothing, but did him no injury. About a quarter of a mile from Mr. Sullivan's stood a small house, occupied by Dennis, or as he is more familiarly known here, Dennie Morgan and his sister; a small boy also lived here with them. It seems that they saw the storm approaching, and were about to enter the cellar for safety. The boy reached it, but the others did not. Miss Morgan was found about fifty yards from the house, and he one hundred and fifty. Every bone in their bodies appeared to be broken. The boy in the cellar was uninjured. The house was carried bodily 100 yards, and strewn in a strip from ten to fifteen feet in width for 150 yards, in a semi-circular form. The shape of the circle would indicate that the whirling demon was in the vicinity of 400 yards in diameter, and that Mr. Morgan's house had been about half way between the vortex and the outer circle. A peach orchard belonging to him was completely uprooted, the roots and branches separated, the branches carried entirely away and the roots scattered in profusion over the face of the country. A few of them were seen over a mile away. Several other houses in this vicinity

were demolished, but no one living in them was injured, though many had narrow escapes. Eastward from here the path of the tornado is marked by destroyed wheat fields, paths cut through hedges and fences and other similar marks peculiar to these depredators. After this fiend had completed his work, as though not satisfied that its work was complete, a hail storm, the like of which has never before been seen here, visited a section with a radius of about three miles each way from here, ruining thousands of acres of wheat. The corn, though stripped of its blades, will probably recover. Trees were much damaged by it and grass and weeds were driven into the ground. In this town there is hardly a whole pane of glass in the north side of buildings unprotected by porches or blinds, and in many cases whole sashes were broken out. The houses are marked and bruised as though struck by hammers.

One gentleman picked up a piece of ice which had fallen, two inches in thickness and two and one-half in length. It is claimed that one was found measuring thirteen inches in circumference, while a party well known states that he measured one which was nine inches in circumference and weighed one and one-quarter pounds. A large number were found which measured from four to six inches, and from the marks on the ground a great portion must have been at least two inches.

The whole theme of conversation here now is the "cyclone." One hears it in the hotel and on the street corners, and some are almost afraid to stay in the town for fear of a repetition of the elemental war. Eight years ago the section between Salina and Bavaria was visited by something similar to this, but nothing like the destruction of property occurred. The funnel-shaped clouds which are peculiar to this kind of storm were smaller but more numerous, aud at that time seven distinct columns were counted in the distance. The people will long remember the 9th day of June, 1881, as a day when the elements conspired to destroy with one breath the work of years."

Further reports of the storm state that the tornado extended into the eastern part of Lyon county, and did great damage to the crops, fences and buildings all over that part of the country. The little town of Americus, near Emporia, is seriously damaged. The United Presbyterian Church, which was of brick—the principle church structure of the place—was literally blown to pieces and scattered for miles around. The Methodist Church, a large and beautiful frame building that had recently been fitted and furnished, was blown off its foundation and almost totally destroyed. In Emporia the storm was not so severe, though many houses and fences were blown down. The north and east addition of the State Normal School building, which had just been finished to take the place of one destroyed by fire two years ago, was unroofed, the walls partially torn down, and the building otherwise damaged. A fine rain accompanied the tornado.

Fuller reports were received from the scene of Thursday night's tornado in Dickinson and Ottawa counties. The work of destruction commenced about six miles north of Salina, where the house of Frank Phillips was destroyed. Within

ten miles of Topeka the first pointer touched the ground, and the house of John Powell was scattered far and wide. The storm then swept down and licked up the dwelling of W. L. Frothingham. This house was a frame 25x35 feet, having two sheds attached. The twister lifted the structure from its foundation, Mr. Frothingham, his wife and cousin being in the sitting-room at the time, and carried it sixteen feet from the ground down into the valley one hundred and fifty yards, and dashed it into splinters on the projecting rocks. George Combs' body was found something over fifty yards from the place where the house stood, with a fence stake driven through the back of his head, and that of Mr. Frothingham about one hundred yards away, the back of his head crushed in, his left leg crushed, his back broken and his scalp cut at the top of the forehead, and peeled off clean to the back of the neck. His wife was among the shattered ruins, one hundred and fifty yards away, her left arm fractured, skull crushed, and jaw dislocated.

The other ruins were the house of Mr. McIntire, one mile east of Topeka; the house and barn of Mr. Davis, one-half mile further on, and the residence of George C. Parker, from which Lester Parker and Miss Nellie Foote barely escaped with their lives.

The next work of the cyclone was the destroying of the house of Mr. Keane, seven miles east, where the devastation and destruction of property was the most complete. Houses, barns, out-houses and farming machinery of every description were torn to pieces in a way to defy description. The monster took up two horses belonging to Mr. Keane and carried them over the Solomon River, a distance of one hundred and twenty-five feet, and landed them safe and sound on the opposite bank. It also carried a Randolph header weighing 250 pounds into the air some distance; thence passing south by east a distance of five miles. The house of Peter Sullivan was taken at this time.

John Cleyton was the next victim of the fury. His place is two miles north of Solomon City. His buildings were entirely demolished, his sheep and one horse killed, and his crops totally destroyed.

After leaving Cleyton's the twister seems to have spent its fury to a great extent. The last of its work was found on the northeast part of Solomon City, where it did considerable damage in a small way to out-houses. A wagon house was unroofed and the wagons raised and left hanging on the top of the two posts twelve feet high. Chickens were divested of their feathers and many of them killed in the eastern part of Solomon City. A large hay press, weighing 6,500 pounds, was raised into the air several feet and deposited upside down. The damage to growing crops was very great.

FRIDAY, JUNE 10TH.

A terrific rain storm, accompanied by hail, wind, thunder and lightning, visited Eldorado, Kansas, June 10th. The electric display was grand. At one time the clouds that hung over the eastern horizon seemed to be bordered with a fringe of blue and yellow fire. Many people thought that a cyclone was coming, but

happily no great damage was done. Corn was flattened to the earth, wheat was blown down and some small buildings overturned.

The severest and most destructive wind and rain storm of the year visited Topeka at the same time. Several small buildings and hundreds of shade trees were blown down, thus resulting in damage estimated at from $1,000 to $1,500.

SATURDAY, JUNE 11th.

Details of the cyclone which passed near Des Moines, Iowa, Saturday evening give the damage as most extensive, and increase the loss of life. It first appeared about six miles east of the city, moving southwest to northeast, in a funnel shape, with fearful velocity and terrific noise. It struck the earth at McGriff's orchard, about five and a half miles south of the city, and went northeast to Wm. Carfield's farm, completely demolishing his new house. Mrs. Carfield was somewhat injured, although not seriously. One hundred bearing fruit trees were blown down by the storm.

The next farm struck was that of John Hayes, the cyclone going cornerwise through his large orchard, destroying 350 or 400 fruit trees. His large barn was completely blown from its foundation and destroyed. Two horses in the stable remained on the floor unharmed. A one-story tenement house 100 yards from the barn was entirely demolished. Parts of a wagon standing near the barn were scattered in different directions. The wagon bed was found a quarter of a mile distant in a slough, and the front part of the gearing was found in a pile of torn up trees some distance off. It is also said that a pump standing in the well near the barn was taken entirely from the place.

The cloud lifted and next swooped down in Camp and Four Miles Township east of the city, totally demolishing the house of Mrs. Johnson, scattering the debris in every direction; thence northeast to the house of Henry Lamb, which was destroyed. Next a barn of John Creerens; next the house of a Swede named Erickson, who was killed by the falling timbers, his skull being crushed in by a heavy beam. The body was blown some distance from the house and carried with cornstalks which had been set on fire by the lightning, and when found the body was badly burned and the brains were oozing from an ugly hole in his head. His wife was so badly injured by the falling timbers that her recovery is considered doubtful, and their little child was lifted in the air and carried a quarter of a mile, where the little unfortunate was found lying in a field so badly injured that its recovery is despaired of.

The next house struck was the residence of Mr. John Walters, two and a half miles west of Rising Sun. The house was torn to pieces, and his little child was killed by the falling timber. Others were more or less injured, whose names could not be learned.

In Camp Township the house of B. F. Peters was blown down, on the Bodwell farm, in which his nephew and family had sought safety in the cellar. The house was blown off the foundation and completely demolished. No injury done to any of the family. Mrs. Snellson's house was blown down and the contents ut-

terly destroyed. Mrs. Barnard's house, occupied by Dick Horton, was completely destroyed. The barn of Wm. Well was blown down, and his house moved. The kitchen of Mr. Thomas' house was blown down and destroyed.

The cloud then lifted again and next swooped down at Colfax, twenty-six miles east. Weser's house, in the east part of town, was blown down, and two houses out of the city occupied by farmers named Shelden, shared the same fate. A house in the east part of the village was lifted from its foundation and riddled, but the family escaped injury by taking refuge in the cellar.

The house of J. R. Stuble was badly damaged, and that of Mrs. Kinsell was unroofed, and the barn of the adjoining house lifted from its foundation and torn to atoms. A. E. Robbins' house was lifted from its foundation and turned upon its end, and Jos. Berkhard's house is in ruins. The two-story house of W. H. Robinson was completely demolished, numberless barns and outhouses were destroyed, and trees torn up in the track of the storm. Five miles west of town and directly south of Mitchellville four farm houses were destroyed by waterspouts. South of Colfax five miles the fury of the storm nearly equaled that in town. Fences were destroyed, fields laid waste, cattle killed, and several persons injured.

Sunday evening a terrific storm of lightning, wind, and rain passed over nearly the track of the cyclone in this city. The Baptist Church, several residences, and other buildings were struck by lightning, but no persons killed. Trees were badly demolished. In the country farm barns and houses and trees were torn down. At Colfax several small buildings were unroofed, windows broken, and trees uprooted. People all fled to their cellars for safety, expecting a repetition of the cyclone. The path of the cyclone was not wide, but it is marked by complete devastation.

Later reports of the storm show that it came down from Minnesota, following the Des Moines Valley through the State and swinging to southwest in Missouri. Along its whole track there is great destruction of property from wind and hail. Farm houses were destroyed, grain broken down, fruit trees destroyed. In Audubon County two men were killed by lightning. The loss will amount to hundreds of thousands.

The Galveston *News*' Waco special of June 13th, says: A fearful hail storm visited South McLennan and the north part of Bell Counties Saturday night. A number of farm houses were torn down. One lady was killed. Two men were badly hurt. Near Crawford several houses were unroofed. A Dallas special says a violent wind and rain storm swept over the city May 12th. The rain fell in torrents, flushing all the streams. Trinity River rose rapidly, and was expected to overflow its banks. The *News*' special reports wind, rain and hail storms in various portions of the State, in many instances totally destroying the fruit and seriously injuring the corn, cotton and wheat crops. The *News*' Taylor special says a hurricane visited Taylor Saturday evening and lasted forty minutes. No lives were lost. Mr. B. N. Train's house was blown down. Two families sustained serious injuries. The Christian Church was blown from its foundation.

The Catholic Church and Odd Fellows' Hall were totally wrecked. Nearly all the barns and outhouses were demolished. Scarcely a house in the town escaped damage. The fences were blown down and trees uprooted for miles around.

A Wells, Minnesota, dispatch of June 13th, says: A heavy wind and rain storm passed over this section Saturday afternoon between 5 and 6 o'clock, the storm from the east and west meeting between Easton and Delavan, going in a northeasterly direction from three to five miles with the fury of a hurricane, carrying death and destruction in its path. An old couple named Chaffee were killed and their building blown to pieces. John R. Evans had his house and barn wrecked. L. P. Roberts' barn was wrecked and his daughter severely injured. Reports continue to arrive, and show the storm to have been very destructive, seven or eight houses and barns having been wrecked and a number of people injured.

A Blue Earth, Minnesota, special says: The most violent storm that ever visited this section commenced at about 4 o'clock Saturday evening. Five inches of water fell in one hour. Trees were uprooted and buildings demolished, but no great damage to crops by hail is reported. Mr. and Mrs. Chaffee, living in the town of Lura, were killed by the blowing down of their house. The barn of J. L. Praber in the same town was unroofed, burying his daughter in the ruins. She was taken out in an unconscious condition, and the injuries may prove fatal.

A Chicago dispatch of June 11th, says: Early this evening a heavy thunder storm, rccompanied by torrents of rain and some wind, struck a section above St. Paul and extended south as far as Omaha, causing considerable prostration of wires and obstruction of telegraph in its course. About 9 o'clock another storm burst in the same locality. In neither case did the injury extend far east of St. Paul. It is impossible at this hour to learn whether any great damage was done. Probably the storm was only temporarily troublesome.

Cherryvale, Kansas, was visited on Saturday night by a young cyclone, damaging some property, particularly the open house, which was lately completed, moving it off the foundation a few inches and wrenching one corner. Some dwellings were blown off their foundations, but no one was hurt.

The southwestern part of Missouri seems to have been visited by the same storm that ravaged parts of Kansas Saturday. The wind was not severe, but an immense amount of rain and hail fell over a large area of country, and did great damage to the crops and window glass. A water spout broke in a little valley in Barry county, in which is situated the town of Seven Star Springs, and before the people could reach the surrounding hills, a torrent of water rushed down, taking with it houses, tents, household goods and animals belonging to those living near the Springs. A woman and five small children, and a man and two women and two children were swept away by the flood, but fortunately they all lodged in bushes and were rescued some hours after.

A heavy rain storm, accompanied by hail, visited Jefferson City the same evening. The hail was small, and did but little damage, while the rain was greatly

needed, as fruits and grain have already suffered considerably from drouth.

The same night the vicinity of Joplin was visited by a heavy wind and rain storm, accompanied by severe lightning. Some buildings were struck, but not much damage was done. The weather is very warm. The thermometer marks 100° in the shade.

Saturday afternoon at about 7 o'clock a rain storm blew over this (Kansas) city, drenching everything with a heavy fall, which continued for probably a half hour, when the drops suddenly ceased to fall and the sky was brilliantly illuminated by a rainbow, lasting a few minutes. The sky then darkened and the wind began blowing in fitful gusts, which soon gave way to a terrific gale, with frequent showers, accompanied by heavy peals of thunder and vivid flashes of lightning, approximating the proportions of a full grown cyclone about 8 o'clock, which swept over the city with full force, tearing up numerous trees, loosening a number of signs and doing other damage of minor importance.

The storm came from a southwesterly direction, and seemed to spend its fury of wind and rain in West Kansas, partly demolishing the large five-story hotel building belonging to Colonel Blossom, which fell with a crash, making a ruin of Jarboe's foundry next door, and seriously injuring a young woman bearing the name of Lillie Sedler. A number of skiffs and dredge boats, etc., along the river were torn from their fastenings and drifted down the stream. A building occupied by a saloonist on Missouri avenue was unroofed. Fences and trees along the bluff suffered considerably.

SUNDAY, JUNE 12TH.

The most destructive cyclone that has ever visited Kansas passed over a portion of this country Sunday afternoon, striking the county at a point seven miles east of Winfield. It pursued its course in an almost easterly direction about eight miles. In width it varied from one-half to one and one-half miles. There was very little rain, it being a wind storm or tornado, in which the air was very heavily charged with electricity. Nothing seemed to offer any resistance to the course of the tornado. Trees were uprooted, houses blown down and the timbers scattered for miles in the surrounding country. Houses of the most durable kind were laid low, a stone structure faring no better than the ordinary box frame building. In some instances valuable orchards were entirely destroyed. Not content with larger game the storm searched low down and played sad havoc with small fruit and vines. Floral, a small place ten miles northeast of Winfield, was destroyed. From twenty to thirty buildings within a distance of two miles or so were completely demolished. A large two-story stone store building at the center and a stone residence near by were tumbled down as if by an earthquake. A frame church, schoolhouse and several dwellings were dashed to pieces, and the timbers scattered like straw, the foundations being left clean. Farm houses for a long distance each way were leveled to the ground, and the contents scattered far and wide. Several persons were injured, a few dangerously, but none killed. A cyclone visited Sumner and Sedgwick counties Sunday night, causing the destruction of a vast amount of property and killing a few and wounding other persons.

It was first seen near Nineveh, on the Arkansas river, three miles from Mulvane Junction, and traveled rapidly in a northeast direction, striking a corn-field near Mulvane. It passed within a mile of Mulvane, and picking up a frame house turned it over twice and smashed it to smithereens. The sewing machine and stove were broken into little pieces; a lady and her child were seriously injured internally, as well as bruised, and the chances are that she will die. The residence of a man named Egan, 20x35, was demolished. This was done by one branch of the cyclone, or water-spout, and another did much damage at Belle Plain. The two united near Mulvane, and it was the two combined that did the work. During the destruction hail-stones as large as a sugar-bowl fell in immense quantities and a hot wind prevailed, making it hard to breathe, and turning the leaves of the corn black. After leaving Mulvane the cyclone wheeled off in a southeasterly direction and struck Flora.

The locality of Osage City, Kas., was visited by a terrible storm yesterday afternoon about 4 o'clock. It was formed near Olivet, in the southern part of the county. The shape and outlines of the cloud were well defined; it was very dark, and apparently hollow. The following is from the account of the *Free Press* extra, issued to-day: Just before it reached the house of a farmer named Powell, ten miles northeast of Olivet, he called to the family to go into the cellar, but they expected it to pass by. Yet, just as it was about to pass, it turned like a mad man, caught the house up whirled it around in the air, and threw it back upon its foundation with great violence, leaving it a pile of ruins. The cellar was filled with the debris, and the family of five people crawled and crouched in a corner, and escaped with a few immaterial bruises and scratches.

A horse was lifted out of the stable and carried over a high hill and dashed upon the ground in a corn field, a mile away. Cattle were lifted from the ground, carried into the air and dashed to pieces. Mr. Powell's fine orchard was totally destroyed, the trees being literally torn out of the ground or twisted into a thousand fragments. Miss Tweed, at Powell's, found the works of her gold watch a quarter of a mile from the house. Their furniture was all destroyed; their bedclothes and wearing apparel have entirely disappeared, nothing but a few sheets being left. Miss Tweed's clothing was torn off, her trunk was lifted out of the house and was carried off, and has not yet been found. From this point the storm moved a little northeasterly, going about one mile north for every three miles east. Mrs. Freeman, a widow lady living near Olivet, lost her house and everything in it. Plaunty's farm house and buildings were left in ruins. Three negro children left at home near Olivet were badly injured, one having since died and it is thought the other cannot live.

A severe cyclone passed over Quenemo, Kas., Sunday about 5 o'clock p. m At Malvern, eight miles northwest of here, one man was killed and one severel hurt. Some six or eight houses were completely demolished and many person more or less injured. Five miles southwest of this place two children were kille and one man probably fatally injured and many others hurt. In this village an within five miles there are some twelve houses completely ruined and many mor

partly blown down. The cyclone seemed to commence on the Marias de Cygnes, west of Malvern, and went in an northeasterly direction, and extended from half to a mile wide. On crossing the belts of timber it literally cleared it off. The Presbyterian church here is a total ruin. Many barns blown down and stock hurt, but none killed except a few hogs. Fences and crops are almost entirely swept away in its track, and household goods and bedding strewn for miles. Have not had any report east of here yet.

A correspondent from Burlingame, Kas., says: The cyclone in this county was more serious than telegraphed from Topeka yesterday. I could not send from here on account of the wires being in bad order. The cyclone first formed between Arvonia and Olivet. It then passed northwest, going out of the county in the direction of Pomona, Franklin county. In its course it killed five persons, including John Rosencranz, John Harper, a man named Brown, two colored children, and a person whose name has not been learned.

The denizens of King City, Missouri, were on Sunday afternoon about half past five o'clock, startled with the approach of the cyclone, making its appearance from the west and holding directly for this point, striking terror to the hearts of all. A feeling of trembling and awe as of certain impending death gives expression to the state of this community. The cyclone had its beginning about two miles south of Rosendale, and twenty miles a little south of west of here. It gathered force as it came on, its mad fury assuming serpentine shape, covering a track varying from 200 feet to a fourth of a mile in width, and sweeping everything clear in its path. It was seen fully an hour before it reached here, and within a mile and a half of here it spread north a trifle, striking the northwest boundary of the town and spending its fury three miles north of here. Houses, stock, trees, shrubbery, and even grass bent and were demolished in its path. The whole track was laid in a desert waste by its furious strides, and the whole territory was strewn with fragments of timber, houses, and domestic articles. While the cyclone lasted the air was filled with material objects, and men were picked up bodily, thrown seventy-five feet in the air and landed a quarter of a mile away. A farmer named Maynard living four miles due west of here, in attempting to escape the cyclone took a wrong course, ran into it and was driven against a fence post and pierced through and through by a four-inch piece of timber. Death ensued shortly after. His grown daughter Grace was carried a quarter of a mile from the house and found in a corn field devoid of clothing except stockings. She, too, died. The rest of the family were saved by fleeing to the cellar of a house that had been blown to fragments and scattered for miles about. R. C. Nelson, a farmer living one mile north of here, while sitting on his back porch reading, was killed. His two sons near by escaped severely injured. The rest of the family were at church. Mrs. Roberts and two children, three miles east of Rosendale, were killed, and house totally wrecked. Several fine country residences were blown to fragments, and several hundred head of stock destroyed, and crops and fine orchards damaged. At Flag Springs several houses were

blown down with considerabie property damaged, and the whole of Empire Prairie suffered incalculable loss.

Hardly had this cyclone passed when slowly rising from the south about four miles distant could be discovered another fully as large as the first, that only spent its fury after a full hour's duration. It took everything in its wake, carrying destruction as it sped on. Outhouses and barns, stock, and every object in its way fell prostrate at its mercy. It took an almost due east direction, resembling in its course much like that of the former, and must have taken in as much territory as did the first one. The house of John W. Catt, four miles south of the town, the first object of its fury, was blown to pieces and the property left a total wreck. Nine persons were in the house at the time. Mr. Catt was severely injured about the head, but will recover. His daughter Bertha, aged three years, had her head crushed, and died at two o'clock this morning. The others were all more or less injured, but none fatally. Frank Berke and others, twenty in all, were sheltered in a farmer's house south of Winslow, and every one was in jured, some probably fatally. The house and barn was a total wreck, with frightful loss of stock. The houses of Phil. Ausmus, Ewing Thomas, Mr. Wolf, John Botts, and Dan Coyle, near by, were destroyed, and it is reported that several more houses have shared the same fate. A report has reached here that a a family of nine, near Berlin, ten miles east of here, were all killed, and another farmer living near Berlin was also killed. A woman with a babe at the breast and another child, names not known, living near Berlin were killed. A young man near Berlin saw the approaching cyclone, attempted to escape, was pitched headlong into a mud hole and suffocated to death. Many more are thought to be killed. As particulars are not all in yet, it may prove even worse.

A terrible cyclone visited the north part of Nodaway county, a few miles south of Hopkins, last Sunday at at about five p. m., causing a great destruction of property and killing James Young. Young's wife was badly hurt, and received injuries that will probably prove fatal. John Crabill and members of his family were also badly hurt, several of whom will probably die. Before the cyclone spent its force it upset the flouring mill of C. S. McMacken and threw it into the river.

Sunday was a terrible day for cyclones in Northwestern Missouri. The atmospheric pressure was very great between four and five o'clock in the afternoon, and during that one short hour no less than three twisters dealt death and destruction in as many paths. The first that came to the knowledge of the St. Joseph *Herald* was from King City and vicinity. This cyclone started, as we have since learned, near Savannah, in Andrew county. The course was northeast through Flat Springs and King City. Many houses were destroyed, and not less than twelve lives lost in Andrew county. At Flat Springs and King City the destruction was much greater. The loss of life in that vicinity was probably fifty men, women and children. The public school building at King City, a large brick, was razed to its foundation. Hundreds of horses, cattle, hogs, and sheep were killed, one man losing eighty cattle, another sixty sheep,

another seven horses. Another cyclone started at Winslow, DeKalb county, another started four miles southwest of Rosendale, passed eastward one mile south of Rosendale. The course of all the above cyclones was east by northeast, Another cyclone started eight miles northwest of Hopkins, in Nodaway county, its course for twelve miles being southeast. It was one-fourth of a mile wide, and nothing escaped destruction in its track. Many lives have been lost in all these cyclones, and the destruction to property is very great.

The outer edge of a fierce wind and rain storm passed Davenport, Iowa, this evening from eight to nine o'clock. The lightning was very vivid and almost continuous. Dispatches state that the storm has been working eastward since the noon before. The town of Colfax was struck by a disastrous tornado, destroying several houses and severely injuring a number of persons. A dispatch says: Reports from the south part of that township show a number to have been badly injured. The rain fell in torrents. Messages received by the train dispatcher of the Rock Island Railroad line state that a heavy thunder and hailstorm passed over Western Iowa this afternoon. The hail was so heavy that several houses were unroofed at Walnut, and the lights broken out of railroad trains and locomotive windows. At four o'clock the storm was traeeling eastward from Des Moines rapidly. The rain literally came down ln sheets for half an hour. At four o'clock this afternoon the storm had reached Brooklyn, and was growing milder.

KANSAS WEATHER SERVICE.

FROM OBSERVATIONS TAKEN AT WASHBURNE COLLEGE, TOPEKA,

PROF. J. T. LOVEWELL, DIRECTOR.

The auspicious weather of the first twenty days of May continued through that month and the first week of June. Since then the weather has been rather too warm for comfort, but frequent showers have continued the favorable prospects of crops of grain and fruit.

A destructive cyclone occurred in Ottawa county, near Solomon City, on the 9th, in which three persons lost their lives. and again on the 12th, a still more destructive tornado visited Sumner and Sedgwick counties, while on the same date a similar tempest was developed in Osage county. In each of these localities lives were lost, and many were wounded, but as yet no careful study has been made of these storms in their connection with each other and with the almost simultaneous cyclones reported from Missouri.

Farmers in the Kaw valley were beginning to cut their wheat on the 13th.

Highest temperature, 91° on the 16th. Lowest temperature, 61.5° on the 24th. Highest barometer, 29.08 on the 25th. Lowest barometer, 28.61 on the

29th. Miles traveled by wind, 10,184. Highest velocity of wind, 41 on the 20th. The usual summary by decades is given below:

TEMPERATURE OF THE AIR.	May 20th to 31st.	June 1st to 10th.	June 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	60.3	62.7	67.0	63.3
Max	79.3	86.8	89.6	85.2
Min. and Max	69.8	74 7	78 3	74.3
Range	19.0	24.1	22.6	21.9
TRI-DAILY OBSERVATIONS.				
7 a. m.	66.0	69.4	74.3	69.9
2 p. m.	76.0	83.2	87.3	82.2
9 p. m.	67.4	70.6	76.7	71.6
Mean	69.2	73.2	79.9	74.1
RELATIVE HUMIDITY.				
7. a. m.	.81	.85	.80	.82
2 p. m.	.74	.65	.64	.67
9 p. m.	.87	.85	.81	.84
Mean	.84	.78	.75	.79
PRESSURE AS OBSERVED.				
7 a. m.	28.92	28.85	28.89	28.89
2 p. m.	28.90	28.84	28.86	28.87
9 p. m.	28.88	28.85	28.87	28.87
Mean	28.90	28.85	28.87	28.87
MILES PER HOUR OF WIND.				
7 a. m.	9.0	10.5	13.2	10.9
2 p. m.	14.1	19.3	21.3	18.2
9 p. m.	10.0	12.1	12.2	11.4
Total miles	2,530	3,987	3,367	10,184
CLOUDING BY TENTHS.				
7 a. m.	7.0	3.5	4.5	5.0
2 p. m.	9.1	3.0	2.3	4.8
9 p. m.	2.2	3.5	2.1	2.6
RAIN.				
Inches	.85	2.12	1.12	4.09

THE PRESSURE OF WIND.

In a paper before the American Society of Civil Engineers, Mr. C. Shaler Smith gives the results of many years' observations of wind pressure and its effects. He has personally visited the tracks of destructive storms as soon as possible after their occurrence, for the purpose of determining the maximum force and the width of the path of the storm in every instance. The most violent storm in Mr. Smith's records was at East St. Louis, in 1871, when the wind overturned a locomotive, the maximum force developed in so doing being no less than 93 lb. per square foot. At St. Charles, in 1877, a jail was destroyed, the wind force required being 84.3 lb. per square foot. At Marshfield (Mo.), in 1880, a brick mansion was leveled, the force required being 58 lb. per square foot. Below these extraordinary pressures there were sundry cases of trains blown off rails, and bridges, etc., blown down by gales of wind of from 24 lb. to 31 lb. per square foot. Mr. Smith observes that in all his examples he has taken the minimum

orce required to do the observed damage, and has considered this as the maximum force of the wind, although, of course, it may have been much higher. Some of the hurricanes were very destructive, the one at Marshfield having cut down everything along a path 46 miles long and 1,800 feet wide, killing 250 people. Mr. Smith has formed the conclusion that notwithstanding these examples, 30 lb. square foot is sufficient wind pressure to allow for in a working specification. As reasons for this conclusion, Mr. Smith expresses doubts as to whether a direct wind or gale ever exceeds this pressure. Whirlwinds may exceed it, but the width of the pathway of maximum effort in these is usually very narrow. Mr. Smith has only found one example, already quoted, wherein the path of pressures over 30 lb. per square foot exceeded 60 feet wide. This pressure is in itself very unusual, and, referring more particularly to railway bridges, it is stated that a loadcd passenger train will leave the rails at this pressure of wind, and consequently not much could be gained by making the bridge strong enough to resist a storm which would blow a train off it.—*Scientific American.*

ENTOMOLOGY.

FRIENDLY INSECTS.

PROF. F. H. SNOW, KANSAS STATE UNIVERSITY.

[*Abstract of Lecture delivered before the Douglas County Horticultural Society.*]

He said in substance, that it was generally believed that insects were a nuisance and a curse in the world, but the study of botany and entomology proves quite the contrary. The Professor made the broad statement that if all insect life could be obliterated from the world, vegetation would deteriorate, and finally die out, leaving the animal kingdom to perish for lack of sustenance, and then proceeded by help of his botanical drawings and the extensive cabinet of insects to prove the proposition.

Almost every tree has its species of insects which feed upon it, and in many cases destroy it. As a rule they feed upon the weaker specimens, thus thinning out the forest, and allowing the remaining trees to grow larger and more perfect. In artificial groves and plantations this necessity does not exist, and then it becomes necessary to employ agencies to prevent this destruction..

Cross-fertilization is one of the most useful and important employments of insect life. The stamens of many plants, which have both fertilizing organs perfect, are not ready to discharge the pollen when the pistils of the same plant are in the proper stage to receive it, hence the fertilizing dust must be conveyed from

agency no seed could be produced and the species would in time disappear. This cross-fertilization seems to be an arrangement of nature to prevent "breeding in and in," as it is called, which process or practice would deteriorate the vegetable as much as the animal species. This then, is nature's own method of preserving the beauty, vigor, and quality of the vegetable world.

Insects act as scavengers. Flies attack the flesh, and other insects the bones of dead animals, consuming them, where otherwise they might be allowed to decompose, putrefying and poisoning the atmosphere. Insects purify water from noxious matter, thereby saving us from sickness which might otherwise ensue. They also help the housekeeper in removing filth from the house. Cockroaches are found more abundant where food and dirt are left around the house. There is a very small insect which is quite tenacious of the human cuticle when the conditions are favorable. This insect performs a very commendable office in compelling its host to resort to the use of soap and water and the fine-tooth comb. Of course the horticulturists of Douglas county are not personally acquainted with this species.

The sexton beetle buries up in the ground dead snakes, mice, rats, birds, &c. The Prof. gave some instances of very wonderful exploits by these beetles, burying up animals in a few hours, which were forty times their own weight. Although this is really a service to man, they do it for the purpose of laying their eggs in the dead animal, on which the larvæ feed when hatched out. The tumble beetle lays its eggs in a small bunch of manure and then rolls it into a good sized ball, which is deposited in a soft spot in the soil for the home of its young; this so far, serves to fertilize the land. Of the class commercial insects, it is only necessary to refer the products of the cochineal, the silk worm, the Spanish fly, and the honey bee, all of which form an important part in the commerce of the world.

It is difficult to estimate the value of the parasitical insects. They prevent the undue increase of the noxious insects and preserve the balance of the different species. The destructive and dreaded Rocky Mountain locust or grasshopper has several kinds of parasites which prey upon and destroy it. Were it not other plants, which can only be done by the agency of insects. Without this for these parasites, its invasions would be more frequent and its ravages much greater. The lady bug family is very serviceable in destroying plant lice, and should therefore be protected as far as possible. The Professor stated that the European cabbage butterfly had lately made its appearance in this country to the destruction of our cabbage patches. It first appeared in Quebec, Canada, having been brought from England in a vessel, and had, like thousands of other immigrants, traveled westward until it had reached Kansas. Its parasite has not yet arrived, but efforts should be made to bring it here as soon as possible or the future prospect for cole-slaw and sour kraut will be slim. At the close of this interesting lecture, of which this is an imperfect summary, the society returned the Professor a sincere vote of thanks.—*Lawrence Journal.*

THE PERIODICAL CICADA, *alias*, "SEVENTEEN-YEAR LOCUST."

PROF. C. V. RILEY.

The present year will be marked by a quite extended appearance of this in- eresting insect, both a seventeen and a thirteen year brood simultaneously ap- earing. The readers of the *Naturalist* are doubtless familiar with the habits and atural history of *Cicada septemdecim* Linn., and those of the thirteen-year race *C. tredecim* Riley) which agree with it in every respect except in the time re- uired for full development. We will, therefore, simply quote here, with brief omments, what was said in 1868, in the writer's First Report on the Insects of Iissouri, regarding the two broods that are to appear the present summer, and hat will be rendering the woods vocal with their rattling song, in the more south- rn parts of the country, by the time the present number is out.

BROOD XVII—SEPTEMDECIM—1864, 1881.

In 1881, and at intervals of seventeen years thereafter, they will, in all prob- bility, appear in Marquette and Green Lake counties, in Wisconsin, and may lso appear in the western part of North Carolina, and about Wheeling, Virginia; Northeast Ohio, and a few in Lancaster county, Pa., and Westchester Coun- , New York.

There is abundant evidence that they appeared in the counties named in Visconsin in 1864, and fair evidence that they appeared that year in Summit ounty, Northeast Ohio, while straggling specimens were found in the same year y Mr. S. S. Rathvon, in Lancaster county, Pa., and by Mr. James Angus, in Vestchester county, New York. Dr. Fitch also records their appearance in 847, or seventeen years previously, in the western part of North Carolina, and r. Smith, in Wheeling, Virginia, in 1830, '47, and '64. The distance between e localities given is very great, and it is doubtful whether all these records be- ng to one and the same brood.

BROOD XVIII—TREDECIM—1868, 1881.

In the year 1881, and at intervals of thirteen years thereafter, they will, in l probability, appear in Southern Illinois, throughout Missouri, with the excep- on of the northwestern corner, in Louisiana, Arkansas, Indian Territory, Ken- cky, Tennessee, Mississippi, Alabama, Georgia, and North and South Carolinas.

Though, as already stated, I published the first account ever given of the ex- ence of a thirteen-year brood, yet, besides the others mentioned in this ronology, this particular brood has been traced since, as having occurred in e years 1816, '29, '42, '55, and 68; and Mr. L. W. Lyon, at the July (1868) eeting of the Alton (Ills.) Horticultural Society, even mentioned its appearance 1803.

In Missouri it occurs more or less throughout the whole state, with the ex ption of the northwest corner that is bounded on the east by Grand river, and

on the south by the Missouri river.* The southeast part of the state, where Dr. Smith has recorded it since 1829, is most thickly occupied. I enumerate those counties in which there is undoubted evidence of their appearance during the present year (1868), viz.: Audrain, Bollinger, Benton, Clarke, Chariton, Callaway, Cooper, Cole, Franklin, Gasconade, Iron, Jefferson, Knox, Lewis, Marion, Macon, Morgan, Moniteau, Pike, Phelps, Pulaski, Polk, Pettis, Schuyler, St. Charles, St. Louis, St. Francois, St. Clair, Warren, and Washington.

It not improbably overlaps some of the territory occupied by the *septemdecim* Brood XIV [a brood which appeared last in 1879], but I do not think it extends into Kansas.

In Illinois it occurs more or less throughout the whole southern half of the state, but more especially occupies the counties from the south part of Adams county along the Mississippi to the Ohio, up the Ohio and Wabash rivers to Edgar county, and then across the center of the state, leaving some of the central counties in South Illinois uuoccupied. To be more explicit, I enumerate all the counties in which it undoubtedly occurred during the present year (1868): Adams (south part, back of Quincy), Bond, Clinton (northwest corner, adjacent tc Madison), Champaign, Coles, Crawford, Cumberland, Clay, Clark, Edwards, Edgar† (especially in the eastern part), Franklin, Gallatin, Hardin, Hamilton, Johnson, Jasper, Jersey, Jefferson, Lawrence, McLean (east end), Macon, Madison, Marion, Massac, Monroe, Pike, Perry, Piatt, Pope, Richland, Randolph, Sangamon, Saline, St. Clair, Union (northeast corner), Washington, Wayne, Wabash, Williamson, and White. There were none the present year, either at Decatur, in Macon county, or at Pana, in Christian county; nor were there any at Bloomington or Normal, in McLean; nor in Dewitt county, which lies south o McLean; nor in Spring Creek, Iroquois county, which is northeast of Champaign

In Kentucky, according to Dr. Smith, it occurred in the northwest corner o the State, about Paducah and adjacent counties south, in 1829, '42, and '55, and it occurred there in 1868.

In Arkansas, it occupied all the northern counties in 1842, '55, and '68.

In Alabama, it occupied Russell and adjacent counties on the east side c Black Warrior river, in 1842, '55, and '68.

In Tennessee, it occupied Davidson, Montgomery, Bedford, Williamsor Rutherford and adjacent counties, in 1842, '55, and '68.

In North Carolina, it appeared in Mechlenberg county, in 1829, '42, '55 and '68.

In South Carolina, the Chester district and all the adjoining country to th Georgia line west, and to the North Carolina line north, was occupied with it i 1816, '29, '42, '55, and '68.

In Georgia, it has occurred in Cherokee county since the year 1816.

*As Mr. Wm. Raucher, of Oregon, Holt county, saw a few individuals in the northeast part of Buchan county, in 1855, it may occur in small numbers in districts even north of the Missouri river.

†Edgar county also has the *septemdecim* Brood III.

In Louisiana, it appeared in Morehouse, Caddo, Clairborne, Washington, and adjacent parishes, in 1855 and '68.

It also doubtless occurs in Mississippi and Indian Territory, though I am unable to specify any localities.

The last simultaneous appearance of these two broods was in 1660, and their appearance the present year will doubtless enable us to perfect our knowledge of the geographical range of either. Already we have received undoubted indications of their early ascension, as the pupæ have been reported either near or upon the surface of the ground in several of the localities indicated.

It will be observed that the thirteen-year brood (XVIII), is by far the most extended, and that it occurs very generally throughout the Southern States, both east and west of the Mississippi. We have gathered together since the last appearance of this brood in 1868, various facts which extend its range in Georgia and Tennessee, and which show that it also occurs in restricted parts of Indiana. *American Naturalist.*

ENGINEERING AND MINING.

THE TEHUANTEPEC SHIP RAILROAD VS. PANAMA CANAL.

W. L. SEDDON, TOPOGRAPHICAL ENGINEER, COLUMBIA, MO.

When inter-oceanic transit was first proposed, science was still in swaddling clothes; and as to the child many things seem possible, nay, even easy, which to the maturer mind of the man present almost insurmountable obstacles, so in the advance of science the scheme of piercing our rock-ribbed isthmus by a canal has proved a herculean task. But although it be such, in the present development of scientific resource it is folly to say that it is impossible to clear away these barriers and let the mighty oceans clasp hands across the breach. We make no such assertion, but we do contend that science in its onward march has done more than simply show the magnitude of the task and furnish means for its accomplishment; that it has brought forward another and better solution of the difficulty, and it is this latter solution, more especially, which we will now briefly consider.

This proposed plan is not to pierce but to surmount these barriers, to lift the laden ships from the waves by means of our great modern motor, to bear them over these ridges and again consign them to the blue waters on the further side. In short, it is the proposed plan of a Ship Railway. And before we enter upon the discussion of its merits, it is but just to say that were they less apparent, the

fact that it is the proposition of so distinguished an engineer as Capt. Jas. B. Eads, would, of itself, entitle it to a careful consideration. For, as a noted scientific journal has said: "He is not a novice in engineering and finance, nor a speculative adventurer, but a scientific and notably practical man, whose large and varied experience in the planning and conducting of great enterprises gives pertinence and weight to any proposition which he may lay before the world."

In considering the subject, the first question which presents itself is: Is a Ship Railway feasible? The views of distinguished engineers on the point, and a glance at the objections to the road will best enable us to decide this.

Many of the ablest engineers (whose names could be mentioned if any doubt on the subject made it necessary) tell us that the proposed plan is undoubtedly practicable and give it their warmest approval.

Secondly, there are practically but two objections that are urged against it. The first, that a ship will be injuriously strained by her passage on the car; the second, that the weight of its own cargo will produce an undue strain when the ship is lifted from the water.

In the first of these objections we find many causes assigned as likely to produce the injury. To understand their force it will be necessary to describe, as briefly as possible, the road and car upon which the ship will be borne; and in this description we will endeavor to answer the more reasonable of such objections in detail. For the facts in the case I am largely indebted to the able article of Capt. Eads in the North American *Review*, and to the March number of the Illustrated Scientific *News*.

The road will consist of a series of perfectly straight reaches, all changes in direction being made by means of turn-tables constructed for the purpose; this prevents the possibility of lateral straining which might be produced in going around curves.

The track will be composed of twelve rails spaced uniformly five feet apart, by which means the pressure produced by the weight of the ship is transmitted over sufficient surface to prevent any yielding of the road-bed. That this is sufficient may be conclusively proved by comparison with the actual pressure to which some of our railroads constantly subject their road-beds. It is no uncommon thing to have freight trains of one thousand tons weight pass and repass without producing the slightest injury; were six such trains placed side by side on parallel tracks they would fully represent the weight of the largest and most heavily laden ship, and yet the space so occupied covers exactly that over which the car transmits the pressure from the ship, thus happily removing apprehensions aroused by another of these objections, viz.: Danger of strains from the depression of the road-bed.

The car, upon which the ship is to be borne, rests, in the case of the largest ships, upon twelve to fifteen hundred wheels, each two feet in diameter and placed at distances of three feet apart, thus making five tons the greatest pressure any one of them will be required to bear, which is exceedingly moderate, when we consider that the wheels will be made capable of sustaining at least four times

this weight without injury; by which means all probability of the breakage of one or more wheels affecting the stability of the car, or of strains from such a cause, is avoided,

The wheels are separate, each having a disconnected axle, which in connection with the straightness of the track above mentioned and the moderate speed at which the car will move, renders derailment practically impossible and therefore removes this difficulty. All irregularities of the track will be corrected by strong steel springs placed above each wheel.

The body of the car will be composed of plate iron girders, placed laterally, of sufficient strength to sustain the whole weight upon them if they were supported only at their extremities, thus insuring an equal pressure upon all parts. These girders, placed above each set of wheels, will be connected longitudinally by some light though strong frame-work. The great power of the ship to resist a flexure longitudinally, furnishes all the needed rigidity in this direction and makes any extensive connection not only superfluous, but, since such connection would greatly increase the weight of the car, actually injurious.

Equal transmission of pressure is further accomplished by making the car shorter than the ship, thus compensating the heavier parts amid-ship.

Upon this car the ship will be supported very much as she would be in a dry dock; the principal weight rests upon the keel block and the remainder on bilge blocks, but unlike the dry dock, each of these supports is in turn supported upon a hydraulic jack, all of which, by means of pipes are connected with one hydraulic pressure. By this simple but ingenious contrivance the ship rests as completely on the water as if she floated calmly on the bosom of the ocean.

Borne on such a car, straining would seem impossible, while with a maximum grade of only one in a hundred the curvature of which from a level plane can can be made so small that a conformity to it would not bend a ship of the largest size, i. e., some four hundred and fifty feet in length, more than one inch from a straight line, a flexure so slight that it may be entirely disregarded.

As these are the most practical difficulties suggested we may fairly conclude that there will be no danger of injurious straining to a ship in its passage on the Ship Railway.

The second objection, viz.: that the weight of its own cargo will produce an undue strain when the ship is lifted from the water, is even more easily disposed of, for in this case we have the logic of facts in our favor; ships having been frequently lifted from the water and placed in dry docks while loaded, without receiving a strain in the slightest degree injurious. In addition to this no ship is judged seaworthy—fit to meet the shocks and strains of even the lighter storms of the ocean unless it is able to sustain a pressure equivalent to that produced by filling her with water, while in dry docks, to her main deck, a much greater pressure than any cargo could ever produce. May we not then conclude the question of *feasibility* as established beyond controversy.

This point granted, we go further; we contend that besides being as feasible

a means of transit as a canal, it possesses the following advantages: 1st a Ship Railway may be constructed in many localities where a canal would be impracticable, thus giving the Engineer a wider field from which to select a location most advantageous from all standpoints. 2d. that it can be constructed for about one-third, and maintained at about the same cost as a canal, thus enabling it to charge lower rates, and still pay good dividends on moneys invested; a decided advantage to all parties concerned. And 3d, that when a growing commerce shall demand increased facilities of transit, as it most certainly will, this means can be enlarged without interfering with what is already in operation.

These advantages, so weighty and apparent, certainly justify our claim that a Ship Railway is the best means of inter-oceanic transit yet proposed. And we may logically consider this conclusion proved for the Tehuantepec Road while there are other advantages applicable to this particular case which we wish to present:

First among these the saving of time. In the rapid growth of our commerce since China and Japan have opened their ports to foreign trade, since the Islands of the Pacific have bloomed into rich gardens from which our merchants may gather golden harvests, and last but not least, since the vast resources of our western coasts have been opened up to the world's trade, there has been an ever increasing demand that this transit be established, and to-day, so urgent is it, that it forms one of the strongest arguments in favor of a Ship Railway, which can be finished in four, as opposed to a canal requiring twenty, years for its completion.

Who can doubt that the Tehuantepec Road, which crosses the Isthmus twelve hundred miles north of Panama, and saves at least fifteen hundred miles to ships from all the great commercial marts of the world—that the Tehuantepec route, which avoids the continual calms of the Caribbean Sea and the Pacific, west of the lower isthmus, making them such dreaded barriers to the sailing vessels —that the Tehuantepec route, which instead bears the ship quickly and safely from the constant winds of the Gulf to the regular trade winds of the Pacific, does not present advantages in point of time which no proposed canal can possibly offer?

The second great advantage claimed for this road is the financial one. Add to the well known business axiom that "Time saved is money gained," the startling difference claimed in the actual cost—that the Ship Railway, crossing a space of a hundred and twelve miles, can be built and put in running order for the comparatively moderate sum of seventy-five millions, while the Panama Canal, cut through the narrowest portion of the Isthmus, will at the lowest estimate, cost no less than a hundred and sixty-eight millions, to which if we add the interest on such an amount at five per cent. (the rate which M. DeLesseps proposes to pay stockholders from time of subscription), for ten years, the shortest time in which its most sanguine supporters hope to see it accomplished, we would have as the great aggregate two hundred and fifty-two million dollars.

Even if other things were equal would not the *financial* difference be a conclusive argument in its favor?

From a National stand-point also the preponderance of advantage accruing to us as a people, seems scarcely less than the one just considered. That it accords with our policy, as set forth in the Monroe doctrine, to endorse this route, the proposition of one of our citizens and untrammeled by foreign powers, is only one of its many claims to a favorable consideration by Government. It also offers to allow discrimination in favor of American merchandize, with many other liberal concessions. The ease with which it can be defended in case of war is also a not inconsiderable argument in its favor.

Again, too—the Tehuantepec route is within Mexican territory, which, as the distinguished proposer of this route well says, "Is a powerful and friendly Republic, whose history has not only pointed out her aversion to European domination, but has shown her ability to deal successfully with an invasion of her territory." Within the boundaries of this Republic we may safely assert that it will be more capable of protection than in the borders of those lesser states, whose changing faith and government is so proverbial.

So that offered control, ease of defense and in territory both friendly and powerful, form a climax of argument which should neither be ignored nor lightly considered.

To sum up, in conclusion, we have seen that a Ship Railway is *feasible*, that it is better than a canal, the only other suggested method, that the Tehuantepec route meets these *general* points, and offers *special* advantages no less decided, viewed from the time-saving, financial and national stand points. With these proved, are we not justified in pronouncing that the Tehuantepec Ship Railway is the best means of inter-oceanic transit.

OLD SPANISH MINES IN NEW MEXICO.

A. R. GREENE.

One of the most interesting spots in New Mexico is the old mining camp in the Cerrillos Mountains, located twenty-five miles southwest of Santa Fe. These mountains comprise a group of five peaks that rise to an elevation of from 500 to 1,000 feet above the plain, with their surrounding foot hills, in all covering an area of thirty square miles. These mountains contain upward of fifty Spanish mines, abandoned two centuries ago, and many of them scarcely recognizable owing to the efforts of the Pueblo Indians to obliterate all traces of them at the time of the insurrection in 1680. The most interesting of these are the Nina del Tiro and Turquoia mines, a few miles north of Cerrillos station, on the Atchison, Topeka and Santa Fe railroad. The first is a silver mine, and yielded $3,000,000, according to the records of the Catholic Church, which received tithes of all mines operated at that time. The shaft is an irregular incline, and can be descended by ladders to a depth of 120 feet, where further progress is interrupted by water. Its entire depth is unknown, but judging from the amount of debris at the mouth of the mine it must have been at least 200 feet. Attempts to sound

it with a line have failed, as the circuitous windings of the mine continue below the water. At the water level the mineral in sight is a fine grained galena carrying gray copper, the vein being four feet in width. This mine is in litigation at present, and is locked and guarded. The sentry subjected our party to a rigorous cross-examination, but finally consented to open the trap door and allow us to descend the ladders into the mysterious depths, from whence we secured several beautiful specimens of quartz crystals.

Chalchuitl, the Indian name for turquoise, is a bluish green stone found in thin veins and pockets, like nuggets, encrusted with a whitish lime formation. The Indians regard it as a sacred stone, and prize it accordingly. They valued it above silver or gold, and endured untold hardships to obtain it. History does not state when they began to mine for it, but judging from the enormous amount of work that has been done, the crude methods employed, and other circumstances, it must have been prior to the discovery of the continent by Europeans.

The turquoise mines, on Turquoise mountain, are three miles north of Cerrillos, and should be examined by every visitor to the Territory. The mountain is literally honey combed with shafts and tunnels and smoke-begrimed caves. There are two immense open cuts, the largest of which is 300 feet in width and at the present time about 100 feet in depth, although in re-opening the principal shaft it was discovered that the depth was fully 200 feet at the time work was abandoned. This immense excavation is in solid rock, the sides sloping irregularly to the center like the crater of a volceno.

About the first of the year 1880, or two hundred years after the Spaniards abandoned them, a New York company undertook to re-open the mines. A shaft was commenced in the debris in the bottom of the excavation I have described, and sunk to a depth of 100 feet, striking almost exactly upon the mouth of the original shaft, which they found in a state of good preservation, with the pole ladders still intact. These ladders are from twelve to fourteen feet in length and about eight inches in diameter, and are notched on opposite sides at intervals of twelve inches for steps. They reach from one landing to another, and furnish the only means of entrance and exit. The ore and debris, as well as the water of the mines, was carried up these ladders in leathern pouches on the backs of the Pueblo Indians, whom the Spaniards upon acquiring the country reduced to the most abject slavery.

Stone tools were used exclusively in mining, excepting a peculiar kind of copper wedges. The theory is that the ledge was heated by building fires against it, and that then the water was thrown upon it, and that the seams thus opened were forced apart by the wedges and the rocks broken up into convenient sizes for handling. These rude tools are found scattered among the debris, and no evidence of any others exist.

Large quantities of gold and silver were obtained in the same manner in other mines. The ore was smelted in rude furnaces constructed of stone and cemented with mud.

From some cause, not easily explained, threre were no supports to the tun-

nels, no timbering, no precautions against caving of the mines; entire dependence having evidently been placed in the solidity of the rock. The tunnels are many of them several feet in width, and high enough to admit of entering without stooping, but others are much smaller and very circuitous, and resemble the burrowings of animals in the earth. As to the depth of the mines, or the extent of the tunnels, nothing is now known, and any estimate would be but the wildest conjecture. The debris covers an area of fully twenty acres around the "crater" to a depth of from five to fifteen feet. How long it required the peons to bring this vast accumulation of rock to the surface can scarcely be imagined, even though a large force of them was employed. With modern appliances for hoisting, it would require many years; with the crude means I have described, a century. On the top are growing cedar trees two feet in diameter, which establish the antiquity of the mines.

History states that in 1680 a land slide occurred, which buried twenty-five Indian miners. The Spaniards ordered the neighboring pueblo of San Marcos to supply laborers to take their places, which demand was refused. The Spaniards resorted to force, and the result was the great insurrection which drove them from the country. When they returned, thirteen years afterwards, no efforts were made to re-open the mines which the Indians had filled up and sought to obliterate. There is a tradition that this was a part of the stipulation when the Indians surrendered. It is certain that since the second conquest the Spaniards and Mexicans have directed their attention almost exclusively to pastoral and agricultural pursuits.

It is recorded that two unusually large and valuable specimens of turquoise were taken from Turquoise mountain, sent to the Emperor of Spain, and placed in the royal crown. Our party secured a few inferior specimens, together with some fragments of the ancient ladders and several beautiful "pin cushion" cacti as mementoes of the trip.

The view from the top of the mountain is remarkably fine. In the immediate vicinity are the Bonanza and Monitor silver mines, now being actively worked; a little farther away Carbonateville, a promising mining camp; beyond these an open plain covered with scrubby cedar and piñon, and beyond this, to the north, the city of Santa Fe, with the white summit of Old Baldy shining above it against the blue sky. To the east and south the Cerrillos range, and to the west, low down a distant valley, a narrow band of emerald that outlines the Rio Grande.

A few miles southeast of Cerrillos station are the ruins of the Aztec pueblo o Molla, a walled town that was flourishing at the time of the Spanish conquest. Unlike other ancient pueblos, this was walled with stone, the remains of which are plainly to be seen at the present time. It must have been a mining town, as old furnaces, piles of slag and cinders are seen on every hand. In the neighboring mountains are numerous shafts and excavations, from whence the ores were derived. There is a tradition that when the Spaniards were driven from New Spain in 1680 they buried $10,000,000 near Molla; but the cache has never been discovered.

A short distance south of the station are the old placers worked by the Indians and Spanish hundreds of years ago. Remains of their ditches may still be seen, and there is abundant evidence that the mines were at one time very rich. Recent discoveries have established the existence of gold in paying quantities throughout the entire range, a scarcity of water being the only drawback to its development. A project is being set on foot to introduce several large steam pumps to bring water from the Galisteo for the purpose of mining by hydraulics.

Cerrillos has the best, if not the only, vein of anthracite coal west of Pennsylvania. It is four feet in thickness, and accessible to the railroad. Mines of bituminous coal of a superior quality also abound, the product of which is being shipped as far west as Los Angeles, California.—*Kansas City Journal.*

BOOK NOTICES.

LITERARY STYLE, AND OTHER ESSAYS, by William Mathews, LL. D; 12mo., cloth, pp. 345; Chicago; S. C. Griggs & Co.; 1881; $1.50.

Dr. Mathews is one of the most prolific writers as well as one of the most popular essayists of the day. His style is attractive, his works are replete with information of a valuable character, and his ideas are illustrated with anecdotes and quotations from the best sources. Everything he writes is of an elevating and instructive character, and a set of his works would fill an important place in any library, especially one frequentedby younger readers. The volume under consideration is no exception in point of excellence. Its contents are as follows: Literary Style, The Duty of Praise, Periodical Literature, The Blues and their Remedy, The Modesty of Genius, Sensitiveness to Criticism, The Ideal and the Real, Fat vs. Lean, Memory and its Marvels, Fools, Angling, Intellectual Playfulness, A Plea for the Erring, The Secret of Longevity, The Season of Travel, Hot-House Education, Originality, The Art of Listening, Who Are Gentlemen? Office Seeking, Americanisms. S. C. Griggs & Co.'s reputation is such that it is almost needless to say of this book that it is a model of good typography in every respect.

THE SCHOOL OF LIFE, by William Rounseville Alger; Boston; Roberts Brothers; 1881; $1.50; for sale by Kansas City Book and News Company.

This small volume of 200 pages contains many gems of thought, expressed in most elegant and beautiful language. The general outline of the work is that the world is the school; God, the founder and head; desire, thought, labor, experience, and example the general teachers; education the business of life; nature the original text book; the lessons learned docility, energy, submission,

faith, love, exemplification; the true aims of the pupils the possession of the body, the possession of the soul, the possession of society, the possession of the universe; closing with the motives in the school, etc. It is exalted in tone and full of elevating, practical suggestions, adapted to both young and old, not only in a moral and religious sense, but also in the literary and physical education and training of children and youth.

How to tell the Parts of Speech, by Rev. Edwin A. Abbott, LL. D.; Boston; Roberts Brothers; 12mo, pp. 143; for sale by Kansas City Book and News Company; seventy-five cents.

Dr. Abbott has long been head master of the city of London school, and is the author of quite a number of works of a similar character, suggested by his daily observation and in the performance of his duties. This American edition is revised and enlarged by Prof. McElroy, of the University of Pennsylvania. The work is really an English grammar, but being designed to simplify the manner of teaching usually adopted in such books, the author prefers this title, and, indeed, he has produced a far more attractive and comprehensive work than is ordinarily found in the schools, at least those of the United States. It is difficult to describe his manner of teaching grammar, even while approving it, without giving copious quotations which we have no space for, but it may suffice to say that it is natural and logical, that his illustrative passages are well chosen and of a character calculated to interest the pupil, and that no one can study this book without being able afterwards to "tell the parts of speech." An appendix on spelling has been added to the second edition, also a summary of definitions, together with an etymological glossary of grammatical terms. The work of the American editor has been confined to adding a few technical terms, paragraph numbers and exercises, with the consent of Dr. Abbott. Teachers will find this little work a very useful adjunct to their text books.

Nests and Eggs of American Birds, by Ernest Ingersoll; parts I, II, III, 8vo, pp. 24, illustrated; Salem, Mass.; Geo. A. Bates; fifty cents per number.

In accordance with the announcement made by us in the June issue of the Review, Prof. Ernest Ingersoll has put forth the initiatory numbers of his beautiful and comprehensive work. They are fully up to the standard promised in matter, illustrations, and typography, and no lover of birds need fear that the most ample justice will not be done them, both by the skilled author and his publisher.

Scientific Sophisms, by Samuel Wainwright, D. D.; 4to, pp. 27; New York; J. Fitzgerald & Co.; fifteen cents.

This is No. 23, Vol. 1, of the Humboldt Library, and is a review of current

theories concerning atoms, apes, and men. It can only be appreciated after a careful perusal, when it will be acknowledged that there are two sides to the questions discussed, and that Dr. Wainwright is a powerful and skillful debater as well as a thoroughly competent man to meet and hold his own with the popular theorists of the day. The first volume of the Humboldt Library will close with the next number, when for $3.00 one can procure the best works of Proctor, Tyndall, Huxley, Spencer, Marcel, Flammarion, Bain, and other prominent modern writers.

OTHER PUBLICATIONS RECEIVED.

Political Economy and Political Science, compiled by W. G. Sumner, David A. Wells and others; 12 mo., paper, 25 cents.—Inter-State Railroads and Their Regulation by Congress, by Robt. P. Harlow; 8vo., pp. 36.—Sewerage: Its Application to Kansas City, Mo., by Robt. Gillham, C. E.; 8vo., pp. 22.—A Primer of Memory Gems, by Geo. W. Hoss. Topeka, Kans.; 16mo., pp. 32, 10 cents.—Inaugural Address of Hon. W. G. Ritch, President of the Historical Society of New Mexico, with the Charter, Constitution and By-Laws of the Society.—Objects of Sex and of Odor in Flowers, by Prof. Thos. Meehan, Professor of Botany, State Board of Agriculture of Pennsylvania.—Notes on Treeless Prairies, by Same.—Antiquities of the Missouri Bluffs, by S. V. Proudfit.—Proceedings of the XIV Annual Session of the Missouri Press Association, held at Sedàlia, Mo., May, 1880.—Address to the Missouri Press Association, convened at Jefferson City, Mo., May 10, 1881, by James B. Price.—Atti Della Societa Toscana di Scienze Naturali, Marzo 13, 1881.—On the Reduction of Air Pressure to Sea Level and the Determination of Elevations by the Barometer, by H. A. Hazen, A. M.—Hints on Orthography, by C. T. Pooler, A. M.; published by C. W. Bardeen, Syracuse, N. Y..—The Mississippi River, and What its Proper Utilization will Accomplish, by J. M. Osborn, Toledo, O.

An interesting fact in connection with our old friends, the Rocky Mountain locusts, was brought to light here during the week. While cleaning away an accumulation of "spalls," mortar and clay in the rear of the Laboratory, the workmen discovered, in the unbroken ground beneath, a considerable number of nests of grasshoppers' eggs, at the depth of six or eight inches. The rubbish above referred to was placed in position in the fall of 1876, shortly after the deposit of the eggs the same fall. These eggs, appearing fresh and healthy when taken from the ground, were placed, by Supt. Graham, under favorable conditions for hatching; and, in due time, a swarm of lively juvenile *Caloptenus spretuses* came from these four-and-a-half-year-old eggs.—*Industrialist.*

SCIENTIFIC MISCELLANY.

KANSAS CITY INDUSTRIES.

Hereafter we shall devote a small portion of The Review to an account of the various industries of Kansas City, and begin this month with

THE KANSAS ROLLING MILL COMPANY.

The works consist of a rail mill, which was moved here from Decatur, Illinois, trains of rolls for making merchant bar, universal iron, splices and spike rod; a spike, bolt and nut factory; a forge and a machine shop.

The shipments of this company in 1880 were as follows: Heavy rails, 19,690 tons; mine and steel rails, 269 tons; fish plates, 4,816 tons; spikes, 2,730 tons; merchant iron, 549 tons; harrow teeth, 72 tons; universal iron, 57 tons; miscellaneous, 54 tons. Total, 28,237 tons. To manufacture this required about 3,000 car loads of iron; 2,500 cars of coal, and perhaps 250 cars of fine sand, fire brick, clay, oil, etc. The number of employees varies from 500 to 600. There are 8 furnaces for rail mill, 2 for the 18-inch train, 1 for the 9-inch train, and 6 for spike rod. The universal rolls are driven by the rail mill engine, and have no separate furnaces The iron from them is principally used for girders and lintels in the new buildings in Kansas City.

To drive the various machines and roll trains there are required nine engines of various sizes, besides five steam pumps. The steam is supplied by eight boilers 28 feet long and 40 inches in diameter, placed so as to utilize the waste heat of the furnaces, and six boilers of the same size in three batteries. Two more boilers for a fourth battery are now being erected.

The principal business of this company is with railroad companies, and they are gradually increasing their facilities with the view of supplying all the iron work required in building a railroad.

THE KANSAS IRON FENCE COMPANY.

Connected with the Kansas City Rolling Mill Company is the Kansas Iron Fence Company, who manufacture all kinds of wrought iron work, garden fences, cresting, girders, anchors, gratings, etc.; some iron bedsteads and several kinds of agricultural implements. This company employs 60 men, and is growing rapidly.

The officers of the Rolling Mill Company are A. B. Stone, President; Ira Harris, Vice-President and General Manager; E. V. Wilkes, Secretary, and D. S. Mathias, Superintendent. Of the Fence Companies the officers are: Ira Harris, President; E. V. Wilkes, Treasurer, and J. R. Brown, Secretary.

For a year past the Kansas Rolling Mill Company has been engaged in experimenting with coal dust as fuel, instead of lump coal, with some remarkable

results. They have a separate building with its own engine and a large amount of valuable machinery. The complete success of this work would be of the greatest benefit to Kansas City, where fuel is one of the most important considerations in developing manufactures.

A special article on the theory and experiments with coal dust fuel will probably be furnished this Magazine before long.

THE CENTER OF POPULATION.

St. Louis is located almost exactly at the ultimate center of population of the republic, and the progress of that center toward its final destination is a matter of considerable interest to the intelligent people of the future great city. There is probably a popular misapprehension as to what the center of population of the country really is. It is often taken to mean that point which has an equal population on opposite sides, but this conception of it is erroneous. The center of population is that point on opposite sides of which the number of inhabitants multiplied by the sum of their distances from it are equal. It is aptly defined as the center of gravity of population, that is to say, the point from which if the whole population of the country were suspended in place, it would exactly balance. This definition of course assumes that every person, large or small, constitutes a unit of weight. If a line be drawn due east and west through the center of population, and all the people on such a line travel to the center, the sum of the distances traveled by those going east and west respectively will be equal. If all parts of the country were covered by a population of equal density, the center of population would be at the geographical center. The geographical center of the country is in Northern Kansas, slightly nearer the western than the eastern boundary of that state, and not far from the thirty-ninth parallel of latitude. Dividing the country by a meridian through this point, the western half is found to be by far the most infertile, and consequently the least able to support population. Multiplying area by fertility, it is discovered that the meridian which divides the country into two parts of equal power to sustain population, passes very near St. Louis. The two zones into which the thirty-ninth parallel divides the country do not differ greatly in sustaining power, and the center of population will eventually rest near that central parallel, which also passes near St. Louis.

The progress of the center westward has been at the rate of about fifty miles during a decade. In 1790 it was east of Baltimore, being then, as it is now, near the thirty-ninth parallel. In 1840, fifty years afterwards, we find it twenty-two miles south of Clarksville, in West Virginia, in latitude 39.02. From this time it quickened its pace, and in 1850 it had reached a point twenty-five miles southeast of Parkersburg, West Virginia, fifty-five miles west of the last position, and in latitude 38.59. In 1860 it was twenty miles south of Chillicothe, Ohio, in latitude 39.03, having made eighty-two miles of westing during the decade.

This increase in its advance was owing to the rapid settlement of the Pacific slope, which not only worked an unusual transfer of population from east to west, but effected an abnormal displacement of the center, by locating the new western population at the longest possible distance from it. If San Francisco be 2,000 miles from the center of population, and St. Louis 400, one person in the former city will count equal to five in the latter in determining its position. Every inhabitant works on the center with a leverage equal to his distance from it, so to speak, hence it is not only the movement of population which affects the center, but also the distance which it moves. In 1870 the center was forty-eight miles east by north of Cincinnati, in latitude 39.15, having made only forty-six miles of westing, and performed the novel feat of veering some fifteen miles northward. But this was the war decade, when the increase of population in the south was almost wholly arrested, and the movement of population westward seriously disturbed. The wonderful increase of the south in population during the past decade has brought the center again back to the central parallel, and it is now supposed to be in Northern Kentucky, five miles west of Covington, in about latitude 39.03. Its position is about ten miles east of the boundary line between Ohio and Indiana, and fifty-one miles west of its location in 1870.

It is well to remark, however, that this latter determination is only approximate. The Census Bureau is said to be ascertaining the population to each square degree of territory for the purpose of locating the center with the greatest practicable accuracy. It is certain, however, that its present position is west of Cincinnati, and that its movement westward during the last decade was fully up to the average of the last ninety years. It has moved westward about 450 miles since 1790, and is now within about 300 miles of St. Louis. An advance at the same average rate would bring it here in sixty years, but as the density of population increases to the westward it ought to move slower in that direction. Still it is not likely that its advance will be materially lessened during the present decade. The tide of population is flowing westward with unprecedented volume, and the capacity for absorption in many favored regions is still immense. A new and heavy movement will follow the completion of the Northern Pacific railroad, and taking everything into consideration it would not be surprising if the advance were greater during the present decade than it was in the last.—*Globe-Democrat.*

NOTES AND QUERIES.

THE MISSISSIPPI AND MISSOURI RIVERS.

I have found in my reading the following names applied to these rivers. If the readers of the REVIEW know of others I should be glad to have them reported :

Indian names for the Mississippi — Meico, Mescha-Sibi-Mescha, Namosi-Sipon, Okimo-Chitto, Mesipi, Misseepe, Meact-Chassipi, and Malbouchia.

French — Riviere deLaConception, Riviere de Colbert, Riviere de St. Louis, and Mississippi.

Spanish — Rio Grande, Rio Grande del Espiritu Santo, Rio de la Eulata, Rio de la Palisada, and Rio de Chuchaqua.

Indian names for the Missouri — Pekitanoui, Missouri.

French — Riviere des Ozages, Riviere de St. Philip.

English — Yellow River. J.

In 1834 there was published in the Osage language, at Boston, Mass., a book entitled, Washashe Wageressa Pahugreh Ise, 1 vol., 18 mo. Is there any reader of the REVIEW who knows of a copy of this book? OSAGE.

The Rev. James French, in his article entitled "Science in Revelation," published in the last number of the REVIEW, is in the fog when he asserts that the real mathematical ratio existing between the diameter and the circumference of *the circle has been found.* I do not know anything about Mr. Parker's investigations in regard to the *quadrature of the circle*, but this I will say: That Mr. Parker never found the exact ratio; and furthermore, the so-called "Parker Formula" is not sufficiently accurate for mathematical computation, as can be easily demonstrated. Respectfully submitted,

J. M. GREENWOOD.

In reply to inquiry in REVIEW, will say: E. P. Walsh, of St. Louis, Mo., is Secretary of the Missouri Historical Society. G. C. B.

MOUND EXPLORATIONS IN NORTHERN MISSOURI.

On June 9, in company with Drs. Kimlin, Berry, and Rutlon, and Messrs. Tindall, Swayze, Murray, W. Witlen, T. Witlen, and laborers, we opened a mound about three miles northeast of Trenton, from which we removed portions of at least twenty-five human skeletons, without finding any relics or implements. Said mound is nearly circular in form, may possibly be a little longer east and west than north and south. We estimate that the mound, only thirty to forty feet in diameter, has contained from 150 to 200 skeletons. There appears to have been a stone floor upon which the bodies have been placed; over them a stone covering, supported probably by stones set edgewise; upon which were placed other bodies; this continuing until there were four layers of corpses and five layers of stone. The bones are now on exhibition at Kimlin's drug store. * * * * Many of the bones crumbled to pieces on exposure. We have, however, an almost perfect sacrum, many femurs, acetabula, portions of ilium and ischium, humerus, spines of scapula, cranial bones, and bones of feet and hands; also tibias.

Respectfully, E. F. HORTON.

The editor of the Missouri *Republican*, in the issue of June 13, in reply to an inquiry by a correspondent in regard to the abbreviation Mo. for Missouri, states that Missouri means muddy, while J. P. Jones, in the last number of the REVIEW, says it means canoe. Which is correct. OSAGE.

Can any of your readers inform me if there were any medals of honor distributed to any of the sailors or soldiers who served in the war of the Rebellion?

A. C.

Can any student of Kansas history inform me how far north Coronado reached in his celebrated march in search of the seven cities of Cibola?

A. C.

THE MAGNETIC SURVEY OF MISSOURI ASSURED.

Prof. Nipher writes as follows: "You will be interested in knowing that a gentleman of St. Louis, whose name is withheld at his own request, has volunteered to pay the expense of the magnetic survey for the coming summer. This arrangement will of course give me more time to work out the subject in a way which will give more valuable results to science than if I were obliged to give attention to the details of establishing meridian lines for the use of surveyors. So far, the action of the Legislature is of advantage. It is perhaps wortny of record as a fact which may be of interest to the future historian, that the Missouri Legislature of 1881 refused to authorize county courts to employ a competent person to establish a true north and south line at the county seat, the compensation for such work to be such as might be mutually agreed upon, not to exceed fifty dollars. This bill was introduced in the House, and was rejected in that body by a decided vote. Comment on such legislation is unnecessary."

REMARKABLE COMETS.

In unenlightened ages comets were looked on with terror, as portending pestilence, war, the death of kings, or other calamitous or remarkable events. Hence it happens that in the earlier descriptions of these bodies, they are generally associated with some contemporaneous event. The descriptions of the comets themselves are, however, so vague and indefinite as to be entirely devoid of either instruction or interest, as it often happens that not even their course in the heavens is stated.

The Great Comet of 1680 is, as already said, remarkable for being not only a brilliant comet, but the one by which Newton proved that the comets move under the influence of gravitation of the sun. It first appeared in the autumn of 1680, and continued visible most of the time till the following spring. It fell down

almost in a direct line to the sun, passing nearer to that luminary than any comet before known. It passed its perihelion on December 18th, and, sweeping round a large arc, went back in a direction not very different from that from which it came. The observations have been calculated and the orbit investigated by many astronomers, beginning with Newton; but the results show no certain deviation from a parabolic orbit. Hence, if the comet ever returns, it is only at very long intervals. Halley, however, suspected, with some plausibility, that the period might be 575 years, from the fact that great comets had been recorded as appearing at that interval. The first of these appearances was in the month of September, after Julius Cæsar was killed; the second, in the year 531; the third, in February, 1106; while that of 1680 made the fourth. If, as seems not impossible, these were four returns of one and the same comet, a fifth return will be seen by our posterity about the year 2255. Until that time the exact period must remain doubtful, because observations made two centuries ago do not possess the exactitude which will decide so delicate a point.

Halley's Comet.—Two years after the comet last described, one appeared which has since become the most celebrated of modern times. It was first seen on August 19th, 1682, and observed about a month, when it disappeared. Halley computed the position of the orbit, and, comparing it with previous orbits, found that it coincided so exactly with that of comet observed by Kepler in 1607, that there could be no doubt of the identity of the two orbits. So close were they together that, if drawn on the heavens, the naked eye would almost see them join into a single line. The chances against two separate comets moving in the same orbit were so great that Halley could no doubt that the comet of 1682 was the same that appeared in 1607, and that it therefore revolved in a very elliptic orbit, returning about every seventy-five years. His conclusion was confirmed by the fact that a comet was observed in 1531, which moved in apparently the same orbit. Again subtracting the period of seventy-five years, it was found that the comet had appeared in 1456, when it spread such terror throughout Christendom that Pope Claxitus ordered prayers to be offered for protection against the Turks and the comet. This is supposed to be the circumstance which gave rise to the popular myth of the Pope's Bull against the Comet.

This is the earliest occasion on which observations of the course of the comet were made with such accuracy that its orbit could be determined. If we keep subtracting 75½ years, we shall find that we sometimes fall on dates when the apparition of a comet was recorded; but without any knowledge of the orbit of these bodies, it cannot be said with certainty that they are identical. However, in the returns of 1456, 1531, 1607, and 1682, at nearly equal intervals Halley had good reason for predicting that the comet would return again about 1758.

De Damoiseau announced that it would reach its perihelion on November 4th, 1835; while De Pontécoulant, after revising his computations with more exact determinations of the masses of the planets, assigned November 13th,

1 A. M., as the date. The expected comet was, of course, looked for with the greatest assiduity, and was first seen on August 5th. Approaching the sun, it passed its perihelion on November 16th, at eleven o'clock in the morning, only three days after the time predicted by De Pontécoulant.

The Lost Biela's Comet.—Nothing could more strikingly illustrate the difference between comets and other heavenly bodies that the fact of the total dissolution of one of the former. In 1826, a comet was discovered by an Austrian named Biela, which was found to be periodic, and to have been observed in 1772, and again in 1805. The time of revolution was found to be six years and eight months. In the next two returns, the earth was not in the right part of its orbit to admit of observing the comet; the latter was therefore not seen again till 1845. In November and December of that year it was observed as usual, without anything remarkable being noticed. But in January following, the astronomers of the Naval Observatory found it to have suffered an accident never before known to happen to a heavenly body, and of which no explanation has has ever been given. The comet had separated into two distinct parts, of quite unequal brightness, so that there were two apparently complete comets, instead of one. During the month following, the lesser of the two continually increased, until it became equal to its companion. Then it grew smaller, and in March vanished entirely, though its companion was still plainly seen for a month longer. The distance apart of the two portions, according to the computations of Professor Hubbard, was about 200,000 miles.

The next return of the comet took place in 1852, and was, of course, looked for with great interest. It was found still divided, aod the two parts were far more widely separated than in 1846, their distance having increased to about a million and a half of miles. Sometimes one part was the brighter, and sometimes the other, so that it was impossible to decide which ought to be regarded as representing the principal comet. The pair passed out of view about the end of September, 1852, and have not been seen since.

The Great Comet of 1843.—This remarkable comet burst suddenly into view in the neighborhood of the sun about the end of February, 1843. It was visible in full daylight, so that some observers actually measured the angular distance between the comet and the sun. It was followed until the middle of April. The most remarkable feature of the orbit of this comet has been already mentioned: it passed nearer the sun than any known body—so near it, in fact, that, with a very slight change in the direction of its original motion, it would actually have struck it. Its orbit did not certainly deviate from a parabola. The most careful investigation of it—that of Professor Hubbard, of Washington—indicated a a period of 530 years; but the velocity which would produce this period is so near the parabolic limit that the difference does not exceed the uncertainty of the observations.

Donati's Comet of 1858.—This great comet, one of the most magnificent of modern times, which hung in the western sky during the autumn of 1858, will be

well remembered by all who were then old enough to notice it. It was first seen at Florence, on June 2d, 1858, by Donati, who described it as a very faint nebulosity, about 3' in diameter. About the end of the month it was discovered independently by three American observers: H. P. Tuttle, at Cambridge; H. H. Parkhurst, at Perth Amboy, New Jersey; and Miss Maria Mitchel, at Nantucket. During the first three months of its visibility it gave no indications of of its future grandeur. No tail was noticed until the middle of August, and at the end of that month it was only half a degree in length, while the comet itself was barely visible to the naked eye. It continued to approach the sun till the end of September, and during this month developed with great rapidity, attaining its greatest brilliancy about the first half of October. Its tail was then 40° in length, and 10° in breadth at its outer end, and of a curious feather-like form. About October 20th it passed so far south as to be no longer visible in northern latitudes; but it was followed in the southern hemisphere until March following.

EDITORIAL NOTES.

THE Annual Meeting of the Kansas City Academy of Science was held at the First Presbyterian church on the evening of May 31. The anniversary address was delivered by Gen. S. R. Bowman, his subject being "The Mistakes of Great Cities." At the conclusion of the address, which was a brief review of the errors in engineering and sanitation in various prominent cities of the world, with practical suggestions on these subjects for our own municipal authorities, the yearly reports of the various officers were read and adopted.

The Treasurer reported the receipts of the year as $224.25, the disbursements, $97.70, balance on hand, $126.25.

The Assistant Librarian and Custodian of the Museum reported the number of volumes in the library as 119, the number of mineralogical specimens 129, the number of geological specimens, including fossils, 476, the number of archæological specimens, 180.

The election of officers for the ensuing year was then held, resulting in the choice of Hon. R. T. VanHorn, as President; Wm. H. Miller, Vice President; Prof. J. D. Parker, Recording Secretary; Theo. S. Case, Corresponding Secretary; Dr. T. J. Eaton, Treasurer; Dr. R. W. Brown, Assistant Treasurer; H. P. Child, Librarian; S. J. Hare, Custodian of the Museum; Dr. George Halley, Member of Executive Committee. The Academy then adjourned until the third Tuesday in September.

CAPT. HOWGATE writes from San Francisco June 10: "The Rodgers has not sailed yet, but expects to get away next week. The Academy here gave the officers of the ship a fine reception last week, at which Mr. C. W. Brooks read a very interesting paper on The Jeannette Expedition."

ALEXANDER W. BROWNE, the Signal Service Observer, U. S. Army, at Leavenworth, Kansas, paid this office a hurried call a few days since. He is a zealous and eareful observer and is doing good work at his post.

Two simultaneous dispatches were received

June 22d, by Prof. Swift, at the Warner observatory, by which it appears that another great comet has been discovered. Prof. Sharpless, of Haverford college, Pennsylvania, states that L. F. Edward saw it with his naked eye, and Edgar L. Larkin, of New Windsor, Ill., also reports seeing it, and that it is a vast new comet. It is located in the constellation Auriga, about eight degrees from Capella, and it is not improbable it may be the much expected comet of 1812, which should appear not far from that locality. There is some question as to whether the honor of discovery and the Warner prize of $200 belong to Larkin or Edwards.

The comet reported to have been discovered in two places in the Eastern states last week was also seen at San Francisco, by Prof. Hanks. It was seen at Bodie, Cal., at 4:43 a. m., where the nucleus was well defined and brilliant. The tail was observed at Tombstone, Ar., at four a. m. with a nucleus apparently half the size of a full moon. The tail is fan-shaped and very brilliant. All dispatches state that the comet was northeast northerly, heading northwest, and just above the horizon.

The unexpected visitor is believed to be the famous comet of 1812, which possessed a head 1,270,000 miles in diameter, with a nucleus in the center 2,640 miles in diameter, and a tail 1,000,000,000 miles long. The comet of 1812 is expected to appear on its return trip not far from the point at which this one is seen, namely, in the constellation Auriga, about eight degrees from Capella.

PROF. SNOW, of the Kansas State University, closes a recent letter as follows: "Please accept my congratulations upon the improved appearance and constantly increasing excellence of the REVIEW."

THE French Government having applied the electric light to four of its light-houses and become satisfied with the experiment, has resolved to use it on all its other sea-signaling stations.

M. A. MEYNDORF, Melter of the United States Assay Office, at Helena, Montana, has been directed by Director of the Mint Burchard to assist E. C. Jewett, at St. Louis, Mo. The latter has recently been appointed Assayer in charge of the latter office.

IN conformity with the vote at the last meeting, the thirtieth meeting of the Association for the Advancement of Science will be held at Cincinnati, Ohio, commencing at ten o'clock, a. m., on Wednesday, the 17th of August, 1881. A large and efficient local committee has been formed and, through its several sub-committees, is engaged in perfecting the local arrangements for the meeting, which will be announced by special circular in a few days. The headquarters of the Association will be at the Music Hall, where members will register as soon as possible after arrival. The Grand Hotel, on Fourth street, has been selected as hotel headquarters. The offices of the local committee and of the Permanent Secretary will be at the Music Hall. The general sessions and the meeting of the sections, sub-sections, and committees, will also be held under the same roof. The circular of the local committee will contain full information in relation to hotels and boarding houses, with which special arrangements have been made, and also the special railroad rates agreed upon.

THE orders for bound volumes of the REVIEW have been more numerous than ever before, and we have been especially gratified by receiving three orders for full sets (four volumes) within the past month; one from Washington City, one from Sioux City, and one from Marion Center, Kansas.

The Geological chart published on page 138 of this number of the REVIEW is a reduced copy of one used by Prof. H. A. Reid, of Des Moines, Iowa, "in illustration of the successional order of sentient life on the earth, as taught by modern science, and showing how naturally and harmoniously the Bible doctrine of angels joins on in its proper place after the age of man."

THE Duke of Argyle is reported dangerously ill of gout at his residence. As he is 58 years of age his recovery is regarded as doubtful.

We clip the following from the London *Journal of Applied Science*, of June 1, 1881:

"Among the American exchanges we receive, this (the Kansas City Review) is one of the best, both for variety of the subjects treated, and the excellence of the articles contributed by many eminent writers on subjects of lasting interest, instead of topics of mere ephemeral importance. There are always good papers on physics, geology, palæontology, astronomy, and ethnology. Many of these we often desire to transfer to our columns. The periodical now enters upon its fifth year."

We learn that the Hon. George B. Loring, the newly appointed Commissioner of Agriculture, will probably reinstate Prof. Riley as Entomologist of that department. Such an act will gratify hosts of friends, not only in Missouri, where the Professor first made his mark, but all over the country, where his ability and zeal are well known and respected.

At about nine o'clock Sunday night, June 19, a large and brilliant meteor was seen passing over this city from southwest to northeast. The nucleus is described as having been as large as a man's head, with a very long tail of a brilliant red color.

ITEMS FROM THE PERIODICALS.

The article on Prehistoric Man, by Prof. E. S. Morse, concluded in this number, was written for the *North American Review*, and is the most exhaustive and comprehensive of any we have seen from any source.

Prof. G. W. Hoss, in sending us a copy of his "Memory Gems," takes occasion to correct our statement of last month that the *Educationist* is a twenty-four page magazine. It is a thirty-two page magazine, and, as we said before, an excellent periodical.

Good Company for May has a long installment of "In the Land of the Midnight Sun," by Lieut. Frederick Schwatka, commander of the Franklin Search Expedition, in which he begins the account of the great Arctic sledge journey, the longest, both in distance and time, ever attempted. It was absent from its base eleven months and a half, and traversed a distance of over 3,200 miles.

The *Atlantic* for July contains, in addition to the installments of Mr. James' and Miss Phelps' serial novels, a great variety of fresh and entertaining matter, including some valuable observations on Trial by Jury in Civil Suits; a picturesque sketch of travel by H. H.; A dissertation on Mischief in the Middle Ages; a paper on Mythology, by Mr. John Fiske; literary criticism, poems, club gossip, etc.

The Popular Science Monthly for June commences with an article upon Physical Education, followed by an illustrated article on Fruits and Seeds; Sunstroke and some of its Sequelæ; The value of our Forests; Production of Sound by Radiant Energy; Compound Political Heads, by Herbert Spencer; Degeneration, by Andrew Wilson; The Natural Production of Alcohol, a translation from the French; an article from Faraday on the Conception of Electricity; Glucose and Grape Sugar,—and a number of other articles, go to make up a most interesting and popular number. D. Appleton & Co., New York.

Van Nostrand's Engineering Magazine, for June, 1881, has been received. A Rational System of Piston Packing, by Prof. Robinson, illustrated; The Metric System; Suggestions for Preventing London Smoke; Roman Building in England and in Italy; Experiments on the Strength of Small Spruce Beams; Gas and Electricity as Heating Agents, by Dr. Siemens; The Effect of Punching on Iron and Steel Plates; The Optical Dynamometer; Capabilities of Standing Heat of Various Building Stones,— make up one of the most interesting numbers of this American *Engineers' Magazine*. D. Van Nostrand, New York.

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REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

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ETHNOLOGY.

CONTRIBUTION TO THE HISTORY OF THE ALEUTIAN ISLES, OR ALEUTIA.

BY ARTHUR B. STOUT, M. D., SAN FRANCISCO, CALIFORNIA.

In the course of the year 1874, the California Academy of Sciences received the donation from the Alaska Commercial Company, of San Francisco, of two skeletons or mummies. These specimens were two from a collection of a dozen or more which were by them presented to the Smithsonian Institution at Washington. A report upon these latter was published by the Smithsonian Institution, and written by W. H. Dall, U. S. G. S., in 1878. To this very valuable essay on "The Remains of Later Prehistoric Man," I refer, with great pleasure, for many important details omitted in this paper.

The two mummies in question have remained in my care, as Curator of the Department of Comparative Anatomy of the Academy, since 1874, and, except to open the cases which contained the bodies, to disinfect and carbolize them, I have not until now ventured to study them. But such is the increasing interest in anthropology; in the prehistoric condition of man; his evolution; his ethnologic and archæologic history, that I have thought it important to disturb these remains and offer the work for comparison with that of other similar researches.

The source whence these mummies was procured is best described by quoting as follows from the report of Mr. Dall:

"The most celebrated of these burial caves was situated on the island of Kaga'mil, one of the group known as the Islands of Four Mountains, or Four Craters. This group is not at present inhabited, except for a short period during the hunting season of each year.

"I visited these islands in 1873, but as the shores are precipitous, and as there are no harbors, the weather was too boisterous to permit us to remain in the vicinity. Even if we had landed, it is probable that we could have done little without a guide.

"The traders in the islands were aware of the existence of this cave and its contents, and one of them, Capt. E. Hennig, of the Alaska Commercial Company's service, had several times attempted to reach it unsuccessfully. In 1874, however, the weather being quite calm, and the presence of a hunting party, which he was taking away from the island, enabling him to find the cave without delay, he visited it and removed all the contents, so far as is known. On their arrival at San Francisco, the Company, who had instructed their agents to procure such material for scientific purposes when compatible with the execution of their regular employment, with commendable liberality, forwarded them to the National Museum at Washington. Two of the mummies were given to the California Academy of Sciences, but all the rest were received by the Smithsonian Institution. It is unfortunate that but few details were obtained as to the exact disposition of the bodies, or mummies, in the cave; the situation and form of the latter, and other particulars which would have had great interest. From accounts received from Father Innokenti Shayesnikoff, previously, I am led to infer that the cave is situated near the shore at a point where the coast is precipitous and without a beach, the landing being on large, irregularly broken fragments of rock, the tables from the cliffs above. The island contains active volcanoes, as I am informed, and in the immediate vicinity of the cave are solfataras, from which steam constantly arises, and the soil is said to be warm to the touch. The rock is of a whitish and ferruginous color and sharp grain. Specimens examined by Dr. Endlich, of the Smithsonian Institution, prove to be a silicious sinter, containing a little alumina and soda, and some hydrous sesquioxide of iron. In the spectroscope traces of lithium and potassium and possibly a trace of lime were seen.

"From this, and from the fact that the atmosphere of the cave is said t have been quite hot, rendering it uncomfortable to remain in, it is possible tha the cave itself may be the crater of a small extinct solfatara.

"With regard to the age of these mummies, as they may be styled, I wa informed, in 1871, by several of the more intelligent natives, that they fixe the date of the earliest interment in the following manner: It occurred in th autumn or winter. During the following spring the first Russians ever seen b the natives of the Four Craters, arrived in the vicinity. These may have bee Trapeanikoff's party, which left Kamschatka in 1758, but did not reach Umna until 1760; or they may have been that of the infamous Pushkareff; or possibl of Maxim Lazeroff; but in any case, they can hardly have been the expeditio

of Bering. In 1757 Ivan Nikiferoff sailed as far east as Unak, being the first Russian to do so, except those of Bering's Expedition, who did not land on any of the Andreanoff group, though in 1741 they saw the shores of numerous indeterminate islands from a distance. The earliest date, therefore, which we can assign to these remains would be 1756, making the oldest of them about one hundred and twenty years old.

"At all events they possess great interest as the best preserved relics of the state of things as they existed immediately prior to the Russian occupation, and when their pursuits and handiwork had not been modified by the introduction of any of the adjuncts of civilization."

The two specimens were preserved, each in an excellent case with glass cover. No implements whatever were found. No. 1 contained the skeleton of a man, and No. 2 contained the skeleton of a woman. This latter had been disturbed and the strappings of the package were off. The former was yet intact and its original binding unbroken. The odor was strong and penetrating, not that of putrefaction, but like creosote; not unlike that of buffalo robes smoke-dried by the North American Indians in their wigwams, only much more pungent. Large quantities of the larvæ of insects were in the cases, showing that animal life had been busy in the bodies.

The hope was now entertained that we possessed, perhaps, the remains of the distinguished toyon, or toygon, Kat-haya-Koochak, the renowned Aleut chief, famous for his courage, enterprise, riches, and love of family. (See Dall's Report, page 9.) But this chief is described as "a very small man," while our chief measures 5 feet 9 inches in the bones. Two units being allowed for skin, flesh, and general shrinkage between vertebræ, would give 71 inches, or 5 feet 11 inches. His cerements are of the simplest kind, while one of the mummies described by Dall was clothed in the finest wrought and most costly fabrics. Hence ours cannot be the remains of this great Aleut.

The strappings of the packages being taken off, a large sealskin envelope carefully wrapping the bodies, and much deteriorated by time was unfolded. Within this, and covering closely the anterior part of the body was the spoiled and disintegrated skin of some large bird, some of the feathers of which were still clinging to the rotted fibres of the skin. The bodies now exposed were yet in some places covered with the skin; in other parts the bones were entirely denuded. The skin was dark colored, desiccated and of pachydermic toughness, requiring the saw, rather than the knife, to divide it. It was also perforated with numerous little round holes made by some boring insect. No traces of viscera remained, but the thoraces were not opened. Whether evisceration had been practiced at the time of embalming, or whether the intrusive animal life had consumed them, was not easy to determine, but the crania were entirely empty, and we can hardly believe that the embalmer removed the brain. The limbs were carefully and most compactly folded on the body, apparently to make the embalmed package as tight and small as possible, and might be laid flat or placed in a sitting posture. The heads were depressed so that the chin settled down

into the pit of the neck, and the lower maxillæ being thus forced down, the mouths were wide open.

It is regretable that photographs of these mummies cannot be offered, as in the picture given by Mr. Dall the limbs are dislocated and distorted, failing entirely to express any idea the embalmers may have desired to perpetuate, or the admirable care and solicitude in their work. The thighs were brought up and doubled close upon the abdomen; the legs folded snugly upon the thighs, and the feet pressed sharp down backward. The arms were laid symmetrically on the thorax, and the forearms bent upon the arms, the hands not crossed in repose upon the chest, but with the fingers curved over the front of the shoulders.* Thus much for the aspect of the bodies.

What may be the origin, we may ask of these people? Whence came they?

It is not probable that an autochthonic race existed in these Aleutian Islands. Such rude, inhospitable storm beaten regions were not likely to be the cradle of a special tribal birth. Regarding these islands as they appear on the map, the idea is forced upon the mind that at some remote epoch the two continents of Asia and America formed one territory. The volcanic nature of the entire region indicates a vast change of the earth's surface by which the constinuity of the continents was destroyed. The long promontory of Aliaska extending from Alaska, nearly touches the easternmost island of the Aleutian chain. A long succession of wild eruption-torn islands in a crescentic line crosses the sea, thence to the Kamschatkan coast; the whole group, hung like a grand festoon of gems formed by Titan hands and resplendent with the illumination of volcanic fires, appears suspended from shore to shore, to adorn the approaches to the Straits of Behring, or rather, in a military view, like a vast circumvallation of fortresses to defend their entrance from invasion. But the Arctic Ocean has its own defences and needs no such gigantic ornament. Only the ruined abutments now remain of the "bridge," which some author calls the Aleutian Islands, by which migrations of peoples passed from continent to continent, and the bridge was the segment of a circle.

This view seems sufficient without seeking a Malay, Japanese or Chinese origin for the natives of the Aleutian Isles. Their progenitors were an autochthonic race. It is a prevailing opinion that a vast invasion of wild tribes from the far northwest poured down upon the ancient mound builders of North America, sweeping them away from their copper mines on Lake Superior, destroying their temples, burial places and fortresses in the valleys of the Ohio and Mississippi, and exterminating their race or driving them back whence they originated, across Texas into Mexico and Central America, leaving no vestiges of them but their teocallis and their mounds. How immense must have been such an invasion and

* In regard to Aleutian burial ceremonies, says Coxe, page 173: "The bodies of poor people are wrapped in their own clothes, or in mats, then laid in a grave and covered with earth. The bodies of the rich are put, together with their clothes and arms in a small boat made of the wood driven ashore by the sea; the boat is hung upon poles placed cross-ways, and the body is then left to rot in the open air."

how persistently continuous in its course, to have so completely obliterated the numerous and extended populations of the Mound Builders, possessed as they were of the defences and weapons of a high civilization. The great nomadic incursions recorded in history, like that of Genghis Khan into Europe, become inconsequential in the comparison.

If such things did occur it must have been at an epoch long anterior to the present condition of the "far northwest." Earthquake and cataclysm, the battles of fires and waters must have created greater disturbance with far more destructive and radical invasions than any human agency could have accomplished. The present state of the physical geography of this "far northwest" utterly precludes the possibility of any such invasions, fulfilled by barbaric hordes. Neither time nor circumstance could accomplish under such physical conditions so gigantic a work and have left not even a mound or a mile-stone to mark its route.

There must have been upheavals of volcanic peaks with their boiling lava chimneys forming mountains merged in the waters with only their summits visible above the ocean, like the island of the "Four Craters," and again a subsidence of territory from the caving in of the vast subterranean cavities emptied of their seething contents. With all this must have occurred an inundation of waters, in which great cataclysm the waters of the Atlantic and Pacific Oceans blended, the grand Gulf stream of the former passing through the Arctic Sea by the Straits of Behring with the equally grand Pacific Black Stream, or Kuro Shiwo. Before this epoch the ancestors of the Esquimaux in America and the Koriaks, the Chukches, or Tungusian Tartars of Asia may have traded, and dwelt in their igloos together.*

Let all this be as it may, at the time that the Russians discovered these islands, the natives of the different groups spoke different languages, and, hence we may infer that the inhabitants of the various groups were the remains of migrations from both America on their east and Asia at their west, as they again coalesced, and were regenerated from the lapse of time.

Some question has been made of the derivation of the name Aleut, and even suggested that it was a term of contempt of the Russian explorers and fur hunters for the islanders, (see Dall's Report page —,) but we find in the work of Wm. Coxe, A. M., London, 1780, Russian Discoveries Between Asia and America, published just 100 years ago, that the word Aleut is Russian, meaning "*a bold rock.*" Such is the distinctive character of all the islands, and, hence seems peculiarly adapted as their title.

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* The pent-up waters of the Arctic Ocean burst through the Behring Strait and overwhelmed the ruins left from volcanic fires—as the waters of the Nevadas by a thousand floods at some epoch tore through the Golden Gate. As a further illustration of this subsidence and upheaval it is recognized that the waters of the Arctic Ocean once penetrated the American continent as far—if not still further—as Great Slave, and Athabasca Lakes, and that that long chain of lakes in the interior of the continent are only the vestiges of the departure of the greater sea. In the same manner as it is conceded that Siberia was once covered by the Arctic waters, the remains of which are the Lake Baikal and the Caspian Sea, while such great rivers as the Lena, Yenessei and Anadyr now drain the mountain lines back to the retreated ocean.

A glance at the grouping of these islands is important to our purpose. 1st. At the northwest of the semi-circular girdle are Behrings Island and Copper Island, where large outcroppings of copper indicate an abundant mine of the metal, and possibly point to a line of copper vein from the shores of Lake Superior over the region of the Coppermine Country in Alaska to this deposit. We may remark in passing, that it is surprising that with this free surface deposit of copper at this locality, no copper implements have been discovered among the relics of the old Aleuts.

2nd. Say SE. are the Aleutian Islands proper, viz: Attak, Semitski, and Shemiya, W. NW. to E. SE.

3d. Then, NE. some six islands, the Andreanoffski group, or *Ostrova*, meaning islands, and

4th. The Lyssie Ostrova, or Fox Island, stretching SE. and N. by E. almost to the Alaska promontory, and the last discovered at the epoch now alluded to.

This last important group contains Umnak, Ounal-askka, or Aghunalaskka, the principal depot of the Alaska Commercial Company, with St. Paul and St. George further to the north, and also the barren deserted isle, one of the "Four Craters" or Kagámil. In a cave of this island, a bold, bluff, mid-ocean, storm-lashed in its arctic clime, but yet still seething and steaming with solfataras, and volcanic heat, is the Mausoleum of our Aleut Chief and all his family. Here we meet him and his progeny on a desolate fragment of the ruptured territory which once united the two great continents—the monumental stone of the ruin not only of the land but the division of unnumbered peoples. Imagination may picture, but cannot surpass the grandeur of the truth. Another division of the Aleutians is:

I. The Kaniagmuts, and II. The Aleuts. III. The "Vaygeli," or Spectral Outlaws. These are supposed to be the original inhabitants who disdained any outside authority, refused to be converted to Christianity, and consequently live, if such really exist, as independent natives or banditti in the interior inaccessable mountains.

The Vaygeli may possibly be only the predatory animals which come at night and carry off the islanders' provisions. But the mythical or legendary belief of the natives points distinctly to ancestral sagas which have been orally handed down to them from generation to generation. We may infer either an extinct prehistoric race with which the present family has no lineal descents, or we may refer the legend to the earliest progenitors of present tribal groups.

As regards our present mummies they are undoubtedly too recent, whether we allow them 120 years, or about 340, according to Captain C. L. Luneuski, to consider them in the light of *prehistoric* remains, or concede to them Mr. Dall's distinction of "Remains of Later Prehistoric Man" Capt. Lunieuski has been a resident of the Aleut Isles for many years, connected with the Alaska Commercial Company. He antedates our mummies many years to the Russian discovery and conquest of the islands. His intelligent studies predicated in par

on the diversity of their languages, gave to the Aleuts a divided descent, in part from the Esquimaux of America, and the Mongoloids of northeastern Asia.

The Russian explorers and fur-hunters of importance in the discovery of the various islands were:

Bering in	1728
Bering and Tcherihoff in	1741
Nevodsikoff in	1745
Serebranikoff	1753 to 1756
Trapesnikoff	1758 to 1760
Bethshevin . . . . reached Alexsu, furthest island east.	
Tolslyh	1760 to 1764

These navigators, with few exceptions, treated the natives with great barbarity. Many of their expeditions were failures and their vessels wrecked; several of them were burned by the natives. All of them suffered great hardships. Of their vessels, says Coxe, page —, "Most of them which are equipped for these expeditions, are two masted; they are commonly built without iron, and in general so badly constructed that it is wonderful how they can weather so stormy a sea. They are called in Russian *Skitiki*, sewed vessels, because the planks are sewed together with thongs of leather. Some few are built in the river Kamschatka, but they are for the most part constructed in the haven of Ochotsk. The largest are manned with seventy men, the smaller with forty men."

Hence the Aleuts, as naval constructors, with their elegantly and artistically built bidarkas and baydars far excelled in skill their abusive invaders. But these latter had guns. In their warfare they displayed much military invention. To avoid the guns they constructed large double screens made of seal skins, stuffed between with dried fibre of grass, and advanced toward the vessel, pouring upon its deck their missiles from behind, and finally setting fire to it with sulphur found in their island craters.

Inside of the war faculty, and touching the home and domestic idea, wild to our appreciation as it may be, we are taught by the elaborate and exhaustive report of Mr. Dall on the mummies from our "Four Crater" cave, that their art work by their women, whether the result of nearly lost hereditary culture, or of native original industry, patience and invention, was high in its excellence. (See report of Case 17478 in the Museum of the Smithsonian Institution, page 11 of Dall's Report, cited). This ethnological description is rich in its suggestive text. How did the Aleuts learn to make these extra fine fabrics, with nothing but Aleutian raw material? Our present chief is silent but he left head enough to explain it all.

In brief, from all this we can derive enough to feel sure that this ancient folk, after their own way of thinking, education, and old civilization, possessed a high sense of religion, believed in a future life, as proved by their devoted funeral ceremonies, worshipped a divine creator; appreciated the love of home, were profoundly impressed with the devotion due to the family bond. Still further may we trace the illustration, for if cranial capacity and form can be regarded as

the index of mental ability, we have shown that the eagle-like tenant of his northern fastness was worthy of his eyrie. Again, will it appear that here on the confines of nations, in the same tomb, the two great types of the human races, the dolicocephalic and the brachycephalic heads, were together embalmed.

When the Russians discovered the islands the Kamschatdale interpreters, who could speak the language of the Aleut group could not understand the dialect of the natives of the Fox Islands. To obtain their objects they resorted to the cunning device of utilizing the paternal affection of the chiefs. Under pretense of keeping the peace and insuring the tribute of seal skins, exacted by the Russian Government, they caused the sons of toygons, or chiefs, to be delivered to them as hostages. These they sent to Kamschatka to acquire the Russian language. The celerity and aptitude with which these boys learned to interpret went far to prove the natural intelligence of the people so more than barbarously treated by them as barbarians. As reward for their services they converted them as usual to Christianity, but piously took their skins; nor did they fail to appropriate their women, which, as "*ante Trojam fuit*," was always the cause of their wars with the Russians. Their hospitality, kindness, and indispensable aid to the invaders of their realm were devoted and unceasing, until deceived, as were other Indians by Cortes and Pizarro, by lust, and the "*auri sacra fames*."*

The existence of three languages, or perhaps dialects, may be inferred, for Coxe states, (page 264,) that the inhabitants of Unalaska were called Khigolaghi; those next eastward to Unimak were named Kighigusi, and those of Unimak and Alaxa, were styled Kalaghayekïki. In 1741 Bering sighted and Steller first landed on the American continent. (Coxe, page 277).

The Russians conquered Kamschatka in 1696, taking 45 years to discover the way from shore to shore. As the islands then were peopled, so in probability were their languages introduced, by the various tribes of refugees in quest of safety in flight, or as hunters of game from the shores of both continents, or as they mingled before the continents were cleft apart.

Consul General Heap, of Constantinople, in a recent dispatch, informs the State Department at Washington, that the Turkish authorities have determined to grant the concession desired by Prof. Charles Eliot Norton, of Harvard University, of the right to investigate the remains of an ancient Greek city upon Turkish soil. It will take some weeks for the concession to go through all the red-tape process of the Turkish Government, but there is no reason to doubt that the expedition will be on its way next month, and that the work will begin at the ancient city early in February. This expedition is unprecedented.

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* Their phallic customs are more worthy of leniency than are the morbid abuses of other people.

ANTHROPOLOGY.

ARCHÆOLOGICAL RESEARCHES IN NICARAGUA.

Number 383 of the Smithsonian Contributions is an important addition to our knowledge of Ancient America, entitled "Archæological Researches in Nicaragua," by J. F. Bransford, M. D., Passed Assistant Surgeon. U. S. Navy. Washington City: Published by the Smithsonian Institution, 1881." Dr. Bransford made three journeys to Nicaragua; one in 1872, with Commander E. P. Lull, a second iu 1876, when several months were spent in archæological explorations, and a third in 1877, at which time the author's investigations were extended to Nicoya, in Costa Rica. Excepting the last named excursions, all the excavations were made on the Island of Ometepec, and to a slight extent near San Jorge on the mainland.

The geology and natural scenery of the island, the lake, and the surrounding country, are so graphically described that the reader will have no trouble in following the narative and in catching the relation between the sites explored and their environment. The hacienda of Don José Angel Luna having been placed at the author's disposal in 1876, most of the work was done in that vicinity. To reach the burial vessels it was necessary to dig down through a layer of light ash and volcanic cinder, a second of old lava much decomposed, a third of gritty ash, to the fourth, of black sand similar to that now forming the neighboring beach. Pottery, beads, shells, human bones, etc., the necessary concomitants of such a site, were found in abundance. The great interest of the exploration, however, and the *raison d'être* of the book are the burial jars; some globose, others with wide flaring mouths, but the greater number belonging to the unique shoe-shaped burial urns of coarse red material, over the mouth of which were placed delicate bowls of thin yellow ware elaborately painted.

To the description of the covers which are called Luna ware, especially to the elucidation of the designs upon the exterior and the interior surface, Dr. Bransford gives the greatest attention. It is very much to be regretted that his artist is so far behind him; indeed, in a few instances, has omitted from the drawing the very features alluded to in the text. It is a grave fault of nearly all who attempt to illustrate savage technique that things are represented more regular and beautiful than they really are. In this instance, however, the picture falls very far beneath the reality. The two plates of photolithographs at the end are worse still, the objects seeming to be blurred and out of focus.

On page 15—19 will be found a detailed list of the burial urns, giving their shape, the width and depth of both jar and cap, and the position and the contents of each. The author, after reviewing what has been said concerning the origin of the shape of these unique objects, inclines strongly to the view that they

are rude representations of birds. Stone graves similar to those of Tennessee, and mounds also, occur in the locality examined. Stone images already made familiar to us by Stephens and Squier, and rock carvings form the closing pages of the chapters devoted to Ometepec. Chapter III relates to Palmar, on the mainlaind, in the department of Rivas, northwest of San Jorge; Managua; San Juan del Sur; and a pottery manufactory near San Jorge. Chapter IV gives a description of Nicoya and an enumeration of objects in greenstone. The concluding chapter is devoted to the historical relations of the tribes formerly inhabiting the region, beginning with the Aztec tribes of the conquest and working back to the people of the shoe-shaped burial jars, "more closely connected with the South Americans than with Nahuas and Mayas of Mexico and Guatemala." —*American Naturalist.*

NORSE MYTHOLOGY.

The traveler in Switzerland passing from one village to another finds himsel ever and anon at the foot of a glacier, where he beholds in the weird cathedral out lines the crystallized remains of the soft and plastic snow,—in its high mountair origin so homogeneous and so circumscribed, in its terminations so widely sepa rated and so strongly individualized. The same is true of the world's mytholo gies, all having their origin in the sensitive spirit of man as it ponders over anc reaches after the unseen cause of all phenomena, but transformed into distinc systems through the laws of nature and the influence of circumstance. The com parison of these various resultant forms constitutes one of the most valuable chap ters in anthropology. It is impossible to attempt a scientific classification, mucl less to make reliable deductions until all the descriptions are in. We are indebt ed to S. C. Griggs & Co., of Chicago, for the third edition of a volume upo Norse Mythology, by Prof. R. B. Anderson. The introductory portion of th work, though written in a style of glowing enthusiasm, does not please us s much as parts I, II and III, relating to the creation and preservation of th world, the life and exploits of the gods, and Ragnarak, or destruction and reger eration. The three sections are dedicated to Urd (was), Verdando (is), Skul (shall be).

The chief depositories of the Norse mythology are the Elder or Saemun Edda (poetry) and the Younger or Snorre's Edda (prose). The former consis of thirty-nine poems collected by Saemund the Wise (1056—1133), eleven which, embodying the system of mythology, are minutely analyzed in the volum The Younger Edda was written by Snorre Sturleson, the author of the *Heimskring* (1178—1241). In addition to these it is necessary to study all the Iceland Sagas, the Anglo-Saxon Boewulf's *Drapa*, and the Niebelungen Lied.

The gods and goddesses (*æsir* and *ásynja*) dwelling in Asgard are Odin (chi of the gods), Thor (god of thunder and keeper of the hammer), Balder (summe sunlight), Tyr (Zeus, the one-armed god of war), Brage (god of poetry), Heimd

the heavenly watchman), Hoder (the Norse Cain), Vidar (slayer of the Fenris volf), Vale (brother of Balder), Uller, Forsete (the peacemaker), and Loke (the vil giant-god). The goddesses are twenty-six in number. Odin's hall is the great Valhal. The tree Ygdrasil, striking its roots through all worlds, spreading its ife-giving arms through the heavens, and furnishing bodies for mankind from its oranches is beautifully described (188, and 205). The second part of the volume, 215—409, constitutes a perfect classical dictionary of Norse mythology, adding o its richness of detail the enthusiasm of intense sympathy.

The final destruction of the world, and regeneration of gods and men, is called Ragnarak. This theoktonic myth is wanting in Greek mythology. Ragnarak is an outbreak of all the chaotic powers, a conflict between them and the established order of creation.

The student of comparative mythology, upon taking a work of this class in his hand, almost instinctively asks what the author will do with his body of myths. t is possibly to run any theory to extremes and to say some very silly things, as Tylor and Baring Gould have shown us. Here is the point where the sympathetic eader trembles for his author. Professor Anderson, while taking the nature of Norse mythology, handles the subject with extreme caution. The myth reflects nature and society, the one inextricably in communion with the other. The harsh climate of the North modified not only the Norse Mythology, but also nolded indefinitely the national character, and then the two acted and reacted upon each other.—*American Naturalist.*

CRUISE OF THE CORWIN IN BEHRING SEA AND THE ARCTIC OCEAN.

Document No. 118 of the Treasury Department, Nov. 1, 1880, is a report of the cruise of the U. S. Revenue Steamer *Corwin*, commanded by Captain C. L. Hooper, U. S. R. M., in the Behring Sea and the Arctic Ocean. In addition o the customary duties of the Revenue Service and the search for missing whalers, Capt. Hooper gave a great deal of attention to ethnological research. The sad story is told of the starvation of several whole villages on St. Lawrence Island, indeed over four hundred natives had died in this manner upon this one island in two years. The author attributes the great mortality to the improvidence caused by whisky. It seems rather heartless, but really, four hundred skeletons, or even crania, of this homogeneous group of people, would be a precious acquisition to any museum.

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, May 24th, 1881.

Much attention is being devoted to the causes which determine the aptitude or immunity with animals for maladies. This is in a general sense called medical geography, as a physician who has prescribed for patients in various parts of the world, and belonging to different races—the white, yellow, and black, has been able to note the diversities in the same disease and the contradictions in the remedies employed. The true social peril, hardly discovered before we became aware how to conjure it, lies in those legions of animalcules or microbes, that surround us, and in the middle of which we live. M. Pasteur has revealed them to us as the factors in infectious diseases. Claude Bernard has demonstrated the community which exists between animals and vegetables—phenomena of movement, of sensibility, of production of heat, of respiration, of digestion even, for there are the Drosera and kindred carnivorous plants. Iron cures Chlorosis in vegetables as well as in animals, and chloroform and ether render both insensible. There resemblances are more striking still between animals. After Baudrimont insects are, in presence of alcohols, chloroform and irrespirable gases, similarly affected as man. Many maladies, too, are common to man and several species o animals; and this organic identity is best illustrated in the relationship betwee epidemics, and epizootias, cancer, asthma, phthisis, small pox, rabies, glanders charbon, etc., afflict alike man and many species of animals. The difference between races are not less remarkable, odor and taste for example. Accordin to anthropohagy, negroes are best, and white people most detestable. Broca re marked, that in the dissecting-room the muscles of the negro putrified less rapid ly than those of whites. It is perhaps to these anatomical differences that th diverse action of the same poison, in the case of races or species, may be attributed On certain rodentia belladonna exercises no influence; morphine for a horse is violent stimulant; a snail remains insensible to digitalis; goats eat tobacco wit impunity, and in the Tarentin the inhabitants rear only black sheep, because a plar abounds which is noxious for white sheep. The nature of these conditions is a mys tery for science. The Solanæ tribe of plants furnish a principle which, as its name in plies, produces consolation or forgetfulness, by acting on the tissues of the brai where resides the organ of thought; now on the authority of Professor Bouchard these opiates have the less of effect in proportion as the animals possess the le of intelligence. To the same anatomical peculiarities must be ascribed the choi that disease makes in such or such a race. Glanders for instance, so virulent wit the horse, the ass, and man, produce in the case of the dog only a local acciden peripneumonia, so contagious among horned cattle, is more benign in its action c

Dutch than other breeds of stock; the cattle plague that decimates so many farms, is communicated by cattle to each other from the slightest contact, while the closest and most constant association is necessary to communicate the disease to sheep, and even when they are affected, its action is not severe. Further, that plague only attacks ruminant animals—oxen, goats, sheep, zebras, gazelles, etc. Ten years ago this plague broke out in the Jardin d'Acclimatation; not a ruminant escaped, and also one animal not of that class, a little tenant nearly related to the pig—the *peccari.*

Now, Dr. Condereau has demonstrated recently, that the stomach of the pig has a rudimentary organization recalling that of the ruminants. Clearly the stomach of the peccari, and perhaps that of the pig, present a favorable medium for the parasitical microbe peculiar to the rhinderpest. In the potato disease again, all the varieties are not affected with the same degree of violence, it is more marked in its action on the round yellows than the reds, and on the latter, rather than the pink. But the symptoms even of the same malady differ, the parasite's attacks on the tissues being dissimilar. Oak galls are produced from the prickings of insects; now around the same larva, often four varieties of galls are recognized. In the case of consumption in cattle, the disease marches slowly; in that of pigs it takes the galloping form, as with man.

Each people or nation has its peculiar pathology and also its peculiar cures. A negro can take a dose of tartar ten times more excessive than a white; the same dose of brandy given to a black, a yellow and a white, will not produce on the three men, either drunkenness at the same moment, or intoxication at all. Mulattoes can sustain more drastic aperients than other races; the negro does not suffer from yellow fever, but he readily falls to phthisis; he will catch the cholera more quickly than a white. Human races where they may catch the same intermittent fever at the identical moment and in the same swamp, will not the less display different types of fever. Dr. Crevaux has shown that a certain insect with the North American Indian is not the same as with the negro or the maroon, and both differ from that peculiar to Europeans.

M. Pasteur's beautiful experiments have conclusively demonstrated that fowls do not catch the *charbon*; now the vital warmth of birds is from seven to nine degrees higher than in the case of mammiferous animals; he imagined that if the fowl was cooled down by baths to the lower temperatnre, it would be liable equally to become affected; he tried, and the result proved he was correct. The absence then, of a certain temperature would be the reason why birds are exempt. The microbes are the agents of infectious disease: when these swarm in the blood of an individual, they seem to leave there something pernicious for parasites resembling themselves, or to bring away with them something necessary to the life of their successors. A glass of sugar and water where leaven has already fermented and yielded alcohol, is incapable of producing a second crop of leaven; similarly the blood of an individual once contaminated, becomes uninhabitable afterward for like microbes. The individual has acquired immunity. Such is the principle of vaccination.

M. Alp. Milne-Eduards states that they are chiefly birds, which give the special character to the animal population of the antarctic zone. One would have imagined that birds, endowed with the means of flight or swimming would be able to migrate to other and more genial regions.

M. Faye has examined the popular idea of the constitution of the moon; the large grey spaces, so visible during the first quarter of our satellite, are not seas, as the ancient astronomers concluded; there is not a single drop of water in the moon even in its most profound pits: the most fanciful names were given to these assumed seas; Felicity, Dreams, Calms, and Crisis, and hence were presumed to influence on our earth, marriages, mental life and maladies. In the moon there is no trace of rubbings of rocks, etc., having never had water, the moon had no agents of disintegration to act on its surface, as rain, rivers, torrents, and snow do upon our globe; all is vacuum on the surface of the moon and nothing preserves so well as vacuum. On looking at Mars through a telescope, that planet presents a different aspect as compared with the moon; it possesses an atmosphere; it has seas and continents, fogs and snow; its north pole is white like the earth's, and the temperature increases as the tropics are approached. It is possible that Mars is inhabited; it has oxygen and watery vapor, but other things are necessary for the sustenance of animal and vegetable life. Plants cannot live without carbonic acid, and if this be absent in the atmosphere of Mars, vegetation being impossible, animal life cannot exist. Is that planet inhabited, but with beings different from us? No, is the response of science, for the more we know of science, the more we see the fundamental laws of nature become general and extend to the whole universe. Everywhere we find the same chemical elements, in the heavens as on the earth; the same affinities, the same combinations, as well in the stones which fall from the sky, in the most distant stars, as in our laboratories. Why then ought it not to be the same with the essential laws of life? Universal physiology cannot then differ from ours. Plants cannot live on a planet where the temperature never rises above freezing point, and never descends below that of boiling water. In the first place germination could not take place, the seed would be frozen; in the second, the seed would be cooked.

There are no volcanoes in the moon, because that would suppose the existence of water, and eruptions are caused by sea water penetrating by fissures into the bowels of the earth, there acting, as Daubrée has shown, on the molten silicates of the internal mass; incorporating with and transforming without extinguishing them, into a boiling and explosive mass. All volcanoes are situated on the borders of sea or oceans, and emit vast quanties of watery vapor. Further, lime is an essential of life. When our planet commenced cooling down, its first envelope was granite, for the simple reason, that the elements of granite, being the lighest of all primitive matters, ought to have kept near the surface. Granite contains no chalk, that indispensable ingredient of organic life, hence, why no fossils are found in the granite, but under the unequal pressure of the solidified crust, and

the unequal cooling of sub-marine regions, fissures were produced here and there in the granite, and the heavy silicates with bases of chalk and iron, were projected upwards to the surface, where the water with carbonic acid in solution, decomposed the silicates, and the lime set free was carried off by the seas. Life succeeded this putting into circulation of lime. But these is nothing analogous to all this in the moon; her presumed volcanoes are mere circuses with depths three miles in profundity, while the deepest of mines is not more than one-third of a mile. The moon is exempt from physical commotions—all there is tranquil; nothing will be changed there again; it is a desert-death forever.

M. Hausez has conducted some very curious experiments respecting the faculty of odor in insects. He placed before several insects glass rods dipped in turpentine and vinegar, the moment he brought these near the antennæ of the insect, the latter agitated their antennæ and immediately returned on their route. Clearly they experienced the odor; but the moment the feelers were cut, the same insect when placed in contact with the rods, gave no more signs of aversion. Ordinary flies that had been attracted by a morsel of corrupted meat, had one of their antennæ cut off and then set free, they flew about as usual, but were no longer able to detect where the rotten meat was.

Tooth grafting appears to be on the increase. Dr. Magital has introduced several improvements likely to make the process still more general, and which was rather in vogue during the eleventh century.

Dr. Boudet is on the point of making a valuable discovery; that of treating pains by means of mechanical vibrations; he has cured several cases of persistent bad headaches and neuralgia. The use of metals as remedial agents has given, since two years, very extraordinary and happy results.

F. C.

BOTANY.

THE TREELESS PRAIRIES OF THE WEST.

PROF. THOMAS MEEHAN.

At a late meeting of the Academy of Natural Sciences, of Philadelphia, Mr. Thomas Meehan remarked that the absence of timber or arborescent growth on the grassy prairies of America, still continued to be a matter of controversy, but he believed that in the light of accumulating evidence, we might now come to a positive decision in regard to the question. The most prevalent belief had been

that trees would not grow on these prairies,—and we have had theories relating to soil or climate, to show why they could not grow. Then there were others who believed that trees did grow there in ancient times, but had been burnt off, and kept burnt off by annual fires.

Mr. Meehan considered in detail, the authors who had propounded various theories, and the distinguished men who had advocated them, and said that it was evident climate could have nothing to do with the question, because in these prairie regions there were often large belts of timber lands, projected like huge arms into the grassy regions, with precisely the same climatal conditions over both. That the soil was not unfavorable, was proved now by the artificial plantations everywhere successful, and that the soil was unfavorable to the germination of tree seed, as suggested by Prof. Whitney, was on the face of it untenable, from the fact that it required but the same conditions for the seeds of trees as for those of herbaceous plants, the number of species of which on the prairies was well known to be very large. Another great gain to out present knowledge, was that since the annual firing of the grassy prairies had been discontinued by the advance of civilization, the timber was everywhere encroaching on them. Among the facts which he offered in proof of this, was a reference to page 505 of the Seventh Report of the Geological Survey of Indiana, where Dr. Schneck shows how land which was once grassy prairie, is now covered with a luxuriant growth of forest trees; to the evidence of Major Hotchkiss, Geologist of Staunton, Virginia, that the Shenandoah Valley, now heavily timbered, was clear of trees in the early history of Virginia; to the discovery of buffalo bones, in caves near Stroudsburg, Pa., by Dr. Joseph Leidy,—now a timbered region, the buffalo only existing in open, grassy countries;* and to various traditions of settlers in some valleys now timbered, that the land was originally clear of trees. He pointed out that in all known parts of the United States at the present time, except the arid regions, where only drought loving plants could exist, the natural result of freedom was the succession of forest growth. Seeds were scattered by winds or animals over acres of cleared and; if such land became neglected, these, again seeding in time, extended the forest area continually. The tallest growing vegetation, like trees, crowded out the weaker, and the forest naturally crowded out the lower growing and weaker herbaceous plants. He illustrated this by reference to the neglected cotton fields of the Southern States.

From all this, the speaker said that it was evident that there was nothing in Nature either now or in the past, to prevent the gradual encroachment of the forest over the grassy plains, till long before the white man came here, the whole would have been completely covered by arborescent growth. Were there any artificial causes equal to the exclusion of trees, and yet permitting an herbaceous growth? If we were to sow a piece of land in the autumn with some tree seed and some seeds of annuals, the latter would be up, flower, mature and scatter their seed to the ground before next autumn, and many of these seeds would be

* Since these remarks were made it has been brought to the attention of the author, that the bones may have belonged to the Wood Buffalo.

washed into the earth, or drawn into the earth by insects or small animals. But tree seed would make young trees which would not again produce seed for ten or more years. If now, at the end of this first season, a fire swept over the tract, the seeds of the annuals which had found a slight earthy protection, would come up again the next summer, again seeding and extending the area. The trees would be burned down, and though perhaps many would sprout, successive burnings would keep them confined to one place. In short, under annual burnings, herbaceous plants could still increase their area annually, but trees could never get far beyond the line they had reached when the annual fire first commenced. There could be no doubt that an annual burning in a tract destitute of forest growth, would certainly prevent the spread of timber, or of any plant that required more than a year to mature seed from the time of sowing. Now, if we look at the actual facts, we find that the Indians did annually fire the prairies.

Father Hennepin, the earliest writer on Indian habits, noted that it was the practice in his time. There is little doubt but this practice of annual burning has been one extending long into the past. What object had they in these annual burnings? They must have known that the buffalo and other animals on which they were largely dependent for a living, throve only on huge grassy plains, and that it was to their interest to preserve these plains by every means in their power. Low as their power of reasoning may be, they could not but have perceived that while grassy herbage throve in spite of fires, perhaps improved under the fiery ordeal, trees could not follow on burned land. What could be more natural than that they would burn the prairies with the object of retaining food for their wild animals? If we have no difficulty in reaching a positive conclusion so far, we may now take a glance at the early geological times. Mr. Meehan then referred to the researches of Worthen, Whittlesley and others in Ohio, Illinois and other prairie regions. On the retreat of the great glacier, the higher lands and drift formation were probably high and dry long before the immense lakes formed from the melting and turbid waters ceased to be.

It was tolerably well understood that many species of trees and other plants which required a temperate atmosphere, retreated southwardly with the advance of the glacier, and advanced to higher latitudes on the glacier's retreat. Thus these higher ridges would become timbered long before the lower lands became dry. Evidence accumulates that man existed on this continent, in the far west, not long after the glacier retreated, though "not long," in a geological sense, may mean many hundreds of years. The lakes of glacial water would gradually become shallower from the deposit of the highly comminuted material brought down from higher land, from the wearing away of rocky breastworks as in South Pass, Illinois, as well as from the opening which would continually occur from nature's ever varying plan of streams under ground. In all events, the drying of these lakes would be from their outward edges first. Aquatics would give way to marsh grasses, and these to vegetation such as we now find generally spread over the prairie region. If now we can conceive of human beings such as we know

the Indian races to be, already in more southern latitudes—having learned the fact that firing would keep down trees and aid in the preservation of the chase—following the retreat of the glacier to the higher lands, and still as they advanced northwardly, firing the plains up to the water's edge, it would certainly account for the absence of arboreal vegetation from these immense lacustrine lands from the very beginning of their formation. Of course with this view we should have to look for some evidences of man's existence, both on the lands which were once under water, as well as those which were timber lands at his first appearance there. He did not know how many such evidences have been or may be found. Man's traces in the past are at best but rare, and they would naturally be much more scarce in lacustrine regions than in lands dry at the same epoch. At any rate, this part of his remarks, he said, must be taken as mere speculation; but, as we could see on the basis of sound scientific investigation why there could be no trees on these grassy prairies within the range of indubitable history, it was a fair inference that some such cause had continued from the beginning; namely, that annual fires had ever been the reason why arborescent vegetation had never had an existence there.

GEOGRAPHY.

UNITED STATES ARCTIC COLONIZATION AND EXPLORATION IN 1881.

The United States has no less than six Arctic Expeditions in progress, at the present time, under Governmental control and direction. It is the only Government that has actually taken the field in this direction, although most of the leading European nations, inspired by such activity here, are preparing for coöperation next year.

These expeditions are divisible into two classes: one comprising those sent out for purposes of exploration and scientific research, and the other comprising those sent out for humanitarian purposes only.

The "Jeannette," the "Howgate" or "Lady Franklin Bay" and the Point Barrow Expeditions belong to the first-class, and those of the Rodgers, Alliance and Corwin to the second-class.

Those in the first-class differ again, and, most essentially in the principles upon which they are conducted; that of the Jeannette being naval and dependent for success upon the ability of the ship to penetrate the ice to high latitudes and return in safety; while those to Lady Franklin Bay and Point Barrow are to establish permanent stations or colonies, where work is to be steadily carried on from a fixed basis and a vessel used only as a transport and auxiliary means of assistance.

It will be interesting to watch the operations of the two plans and compare the results.

In this paper it is proposed to give a brief summary of the different expeditions for future reference, the data being drawn in most instances from official sources.

THE HOWGATE OR LADY FRANKLIN BAY EXPEDITION.

The following official documents show the action of the Government to date in connection with this expedition :

AN ACT *to Authorize and Equip an Expedition to the Arctic Seas.*

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States be, and he hereby is, authorized to establish a temporary station at some point north of the eighty-first degree of north latitude, on or near the shore of Lady Franklin Bay, for purposes of scientific observation and exploration, and to develop or discover new whaling grounds; to detail such officers or other persons of the public service to take part in the same as may be necessary, and who are willing to enlist for such purpose, not exceeding fifty in number, and to use any public vessel or vessels that may be suitable for the purpose of transporting the members of said station and their necessary supplies, and for such other duty in connection with said station as may be required from time to time: *Provided,* That the President of the United States is authorized to accept from H. W. Howgate, and fit out for the purposes of this expedition, the Steamship *Gulnare,* which vessel shall be returned to its owner when the objects of the expedition shall have been accomplished, or when, in the opinion of the President, its services are no longer required: *Provided further,* That the United States shall not be liable to any claim for compensation in case of loss, damage, or deterioration of said vessel from any cause, or in any manner whatever, nor be liable to any demand for the use or risk of said vessel.

Approved May 1st, 1880.

For securing this Congressional action, the friends of Arctic enterprise are under especial obligations to the Hon. J. R. McPherson, U. S. Senator from New Jersey, Chairman of the Senate Committee on Naval Affairs; to the Hon. W. C. Whitthorne, Member of Congress from Tennessee, and Chairman of the Committee on Naval Affairs in the House of Representatives, and to the Hon. Omar D. Conger, then a Member of the House, from Michigan, and now a Senator from the same State.

WASHINGTON, D. C., May 1, 1880.

To the President:

SIR,—I have the honor to tender herewith the Steamship *Gulnare* for the purposes set forth in the Act of Congress entitled : "An Act to Authorize and Equip an Expedition to the Arctic Seas."

This vessel is now at the ship-yard in Alexandria, Va., being strengthened for ice navigation, and can be got ready for sea by the 15th of May, *proximo*, the date upon which it is desirable that the expedition should sail.

Very respectfully, your obedient servant,

H. W. HOWGATE.

EXECUTIVE MANSION, WASHINGTON, MAY 1, 1880.

Captain H. W. Howgate, United States Army, Washington, D. C.:

DEAR SIR,—Your communication of this morning is at had, and the very generous proffer which it contains, of the Steamship *Gulnare* to the United States, for the purposes of the important expedition into the Arctic regions which you have recently projected, is hereby accepted, in pursuance of the authority conferred upon me by Act of Congress, approved this day, entitled "An Act to Authorize and Equip an Expedition to the Arctic Seas."

In connection with this acceptance I desire to express to you my appreciation of the persevering devotion and untiring zeal with which you have labored for the success of this undertaking. It will be a source of patriotic pride if to American enterprise and generosity the honor may yet be due for the practical solntion of the important scientific problem which is the object of the expedition, and which has for so many years engaged the attention of the scientific world.

I trust your efforts may be crowned with success.

Sincerely, R. B. HAYES.

MEMORANDUM.

It is proposed to have the expeditionary vessel ready for sea on or about May 15th, provided, the necessary men and supplies are promptly furnished.

The crew of the vessel will consist of fifteen officers and men, as follows:

One captain, two mates, two engineers, one steward, two firemen and *seven* seamen. These men, and their necessary supplies, are to be furnished by the Navy Department; the men being enlisted for this especial service, as provided in the act. The officers may be commissioned officers of the Navy, or experienced sailors employed for this purpose. The use of the vessel is to be limited to the transportation to Lady Franklin Bay of the permanent exploring and scientific parties, with their necessary supplies. Having landed these, the vessel will return to the United States. It is estimated that the round trip will be made within a period of five months, and an annual visit to the site of the colony or station is contemplated, until it shall be withdrawn or abandoned.

The Navy Department will furnish coal for the several voyages, and will also furnish such articles of outfit and equipment for the vessel as can be supplied, and are required.

The permanent party will consist of officers and men detailed from the army and who will act under the instructions of the Secretary of War.

The supplies for these men—such as food, clothing, shelter, means of transportation, medicines, arms, &c., will be supplied by the several bureaus of th

War Department, upon requisition from the officer in immediate charge of the expedition. The detail is desired of certain selected men now in the service, whose places in their present commands may be filled by the enlistment of an equal number of new recruits. It is requested that these selected men, fifteen in number, with an officer, also selected, be ordered by telegraph to report in person to the Secretary of War, in Washington, not later than the 10th *proximo.*

Approved: R. B. HAYES.

EXECUTIVE MANSION, APRIL, 28, 1880.

Before the *Gulnare* was fitted for sea, difficulties arose with the Navy Department which led to the partial withdrawal of Government aid, but the vessel went as far north as Disco, and left there two members of the permanent party, Dr. Octave Pavy and Mr. Henry Clay, with supplies, etc., and then returned to the United States.

Congress, at its last session, provided for the continuance of the work in the following language:

"Observation and exploration in the Arctic Seas: For continuing the work of scientific observation and exploration on or near the shores of Lady Franklin Bay, and for transportation of men and supplies, to said location and return, twenty-five thousand dollars."

The appropriation was made under the head of the War Department, and the immediate execution of the law was intrusted by the Secretary of War to the Signal Office.

Lieut. A. W. Greely, A. S. O., was assigned to the command, in the following order, which also prescribes the details of the expedition:

GENERAL ORDERS, NO. 35, OF THE ARMY, April 12th.

In order to carry into execution the act approved May 1, 1880, and so much of the act approved March 3, 1881, entitled "An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1882, and for other purposes," as provides for "observation and exploration in the Arctic Seas; for continuing the work of scientific observation and exploration on or near the shores of Lady Franklin Bay, and for transportation of men and supplies to said location and return, $25,000," it is ordered. 1. First Lieutenant A. W. Greely, Fifth U. S. Cavalry, acting signal officer, having volunteered for the expedition, shall take command of the expeditionary force, now organizing under said act, to establish a station north of the 81st degree of north latitude, at or near Lady Franklin Bay, for the purpose of scientific observation. 2. Lieutenant Greely shall have authority to contract for and purchase within the limits of the appropriation, the supplies and transportation deemed needful for the expedition; and the appropriation for this purpose, made by the act approved March 3d, 1881, shall be drawn from the Treasury and disbursed, upon proper vouchers, by the regular disbursing officer of the Signal Service, under the direction of the chief signal officer. 3. The force to be employed in the expedition

shall consist of two other officers, who may volunteer their services; twenty-one enlisted men, who may volunteer from the Army or be especially enlisted for the purpose, and one contract surgeon. The latter to be contracted with at such time as he may be able to join the party. 4. The commander of the expedition is authorized to hire a steam sealer or whaler to transport the party from St. Johns to Lady Franklin Bay, for a fixed sum per month, under a formal contract that shall release the United States from any and all responsibility or claim for damages, in case the steamer is injured, lost or destroyed. The said contract shall include the services and subsistence of the crew of the vessel, and shall require that the said crew shall consist of one captain, two mates, one steward, two engineers, two firemen, and seven seamen—not less than fifteen in all. Such steam sealer or whaler shall not be hired until it has been inspected by an officer, to be detailed by the Secretary of the Navy for that purpose, and found by him fit for the intended service. 5. The expeditionary force shall be assembled at Washington, District of Columbia, not later than May 15th, and at St. Johns not later than June 15, 1881. 6. During their absence on this duty, Lieutenant Greely, and the other officers of the Army accompanying the expedition, will retain station at Washington, District of Columbia. The enlisted men who may volunteer or be specially enlisted for this duty shall receive the pay and commutation allowances (except commutation for quarters and fuel) that accrue to men detached for duty in Washington, District of Columbia. 7. The several bureaus of the War Department will furnish, on requisitions approved by the Secretary of War, the necessary subsistance, clothing, camp and garrison equipage, transportation to St. Johns, New Foundland, and return, medicines, books, instruments, hospital stores, arms and ammunition. The subsistence stores to be furnished as above directed are for sale, not for issue, to the officers and men of the expeditionary force.

In view of the general interest on the subject of the Jeannette, Lieutenant Greely suggested the desirability of sending out a sledge party to Cape Henry to look for traces of the vessel or crew. The correspondence on the subject is as follows:

WASHINGTON, April 4, 1881.

To the Honorable the Secretary of the Navy, through the Secretary of War:

SIR,—I notice in the proceedings of the Jeannette Relief Board the following extract from Captain DeLong's letter: "If I find we are being carried east against our efforts to get north I shall try to push through into the Atlantic by way of the east coast of Greenland if we are far enough north." In this connection the following extracts, showing a northeasterly current, are of interest:

Her Majesty's Ship Discovery, 1779. Beset in 69 degrees North, near Behring's Straits. Drifted to northeast one-half mile an hour.

Captain Beechy, 1828, remarks: "Near Point Barrow it (the current) ran at the rate of three miles an hour and upward to the northeast."

Her Majesty's Ship Enterprise, in 1851 found the mean set of current for seven days near Point Barrow was nine-tenths of a mile per hour and almost invariably to the east- northeast.

Dr. Simpson remarks: "Again in the latitude of Icy Cape the earth's rotation gives them an easterly set, forming an almost constant current along the north coast of America to Point Barrow, whence it pursues a direction to the northeast."

Sir R. McClure says: "The current along the coasts of the Polar Sea appear to be influenced in their direction more or less by the winds, but certainly on the west side of Baring's Island there is a permanent set to the eastward, at one time as much as two knots during a perfect calm."

The drift of a vessel beset by ice depends largely on the prevailing winds. As stated in my testimony before the Jeannette Relief Board, the prevailing winds to the northward of Behring Strait were westerly the winter previous to the Jeannette's entry into the Arctic Sea, which is the general direction. The winds, as observed at Floeberg Beach, 82° 27′ north, 61° 22′ west, the winter of 1875–6, were sixty-four per cent westerly, as were sixty per cent of the winds experienced by Lieutenant Aldrich in his journey of 125 miles to the westward of Floeberg Beach. These facts suggest the possibility of such a contingency as that referred to by Captain DeLong, that he might force his way or drift to Robeson's Channel.

The object of this communication is to ascertain whether you deem it of sufficient importance that I should send from the international polar station at Lady Franklin Bay, a sledge party at the earliest moment practicable to Cape Joseph Henry, in order to see if any vessel is in sight therefrom. Near Cape Joseph Henry a mountain, some 2,300 feet high, affords a wide view. The chances of any discovery are, of course, very remote, but it might be well to spare no pains even for this faint hope. I may add that the distance is but about ninety miles from Lady Franklin Bay and that the trip can be readily made. I shall be pleased to carry out any suggestions or instructions in this respect which may seem advisable to the honorable Secretary of the Navy.

Very respectfully your obedient servant,

A. W. Greely,

First Lieut. 5th U. S. Cavalry, Acting Signal Officer, U. S. Army.

REPLY OF SECRETARY HUNT.

Navy Department, Washington, April 9, 1881.

Hon. Robert T. Lincoln, Secretary of War:

Sir,—I have honor to acknowledge the receipt through you of a communication addressed to me on the 4th inst., by Lieutenant A. W. Greely, who has been assigned to the command of the expeditionary force to be sent to Lady Franklin Bay under the direction of the War Department, in which he proposes, if this Department considers it of sufficient importance, to send from the interna-

tional polar station at Lady Franklin Bay a sledge party at the earliest moment practicable to Cape Joseph Henry to look after the Jeannette or other vessels missing.

The proposition of Lieutenant Greely meets with the hearty concurrence of this Department and is considered an eminently commendable one on his part.

The department has no particular suggestions to make that would be of value to Lieutenant Greely, but encloses for his information a copy of a communication from Rear Admiral John Rodgers, who was president of the Jeannette Relief Expedition Board, in relation to the proposed co-operation of Lieutenant Greely.

Very respectfully, WILLIAM H. HUNT,
Secretary of the Navy.

REAR ADMIRAL RODGERS' SUGGESTION.

In the letter of Rear Admiral Rodgers, referred to by Secretary Hunt, he says:

Cape Joseph Henry in is one of the passages given by Arctic maps as leading from Herald Island into Baffin's Bay, and is, consequently, in the route in which the Jeannette may have been carried by the ice, even though she had not chosen it. So many abandoned whalers have been forced by the northeast current in the same direction that some of them may be found there, even should the Jeannette not be in that direction.

Captain Cogan said, in his examination before the Board, that when the Jeannette passed into the ice near Herald Island a current which, at certain seasons, sets northwest in that locality, had already began to run, and that the Jeannette would be carried northwest by the ice, he thought.

The United States Ship Vincennes, in 1855, found the current running to the northwest, from an anchorage to the northward of Herald Island, so that it is not improbable that the Jeannette may have been carried for some distance to the northwest, and afterward been set to the northeast.

We can only speculate as to her possible position in an unknown sea, with unknown forces acting upon her, and, it may be, constraining her movements, and all the points readily reached should be examined. Cape Joseph Henry is one of the points full of interest, and the offer of Lieutenant Greely should be accepted, I think, with hearty thanks.

The Steam Whaler Proteus, of 688 tons burthen, was chartered by Lieutenant Greely at St. Johns, New Foundland, to transport the party and supplies to Lady Franklin Bay, and sailed from St. Johns, July 7th.

The following orders show the organization of the expedition:

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
WASHINGTON, D. C., June 17, 1881.

SPECIAL ORDERS NO. 97.

1. By direction of the Secretary of War the following named officers and enlisted men are assigned to duty as the expeditionary force to Lady Franklin

Bay: First-Lieutenant A. W. Greely, Fifth Cavalry, acting Signal Officer and Assistant; Second-Lieutenant Frederick F. Kislingbury, Eleventh Infantry, acting Signal Officer; Second-Lieutenant James B. Lockwood, Twenty-Third Infantry, acting Signal Officer; Sergeant Edward Israel, Signal Corps U. S. Army; Sergeant Winfield S. Jewell, Signal Corps U. S. Army; Sergeant George W. Rice, Signal Corps U. S. Army; Sergeant David C. Ralston, Signal Corps U. S. Army; Sergeant Hampden S. Gardiner, Signal Corps U. S. Army; Sergeant William H. Cross, general service U. S. Army; Sergeant David L. Brainard, Company L, Second Cavalry; Sergeant David Linn, Company C, Second Cavalry; Corporal Daniel C. Starr, Company F, Second Cavalry; Corporal Nicholas Salor, Company H, Second Cavalry; Corporal Joseph Elison, Company E, Tenth Infantry; Private Charles B. Henry, Company E, Fifth Cavalry; Private Maurice Connell, Company B., Third Cavalry; Private Jacob Bender, Company F, Ninth Infantry; Private Francis Long, Company F, Ninth Infantry; Private William Whisler, Company F, Ninth Infantry; Private Henry Birderbick, Company G, Seventeenth Infantry; Private Julius Fredericks, Company L, Second Cavalry; Private James Ryan, Company H, Second Cavalry; Private William A. Ellis, Company C, Second Cavalry.

2. In accordance with special instructions from the Secretary of War, Lieutenant Greely will contract at Disco, Greenland, with Octave Pavy, M. D., who will thereafter remain on duty as acting signal surgeon U. S. Army, with the expeditionary force.

3. First-Lieutenant A. W. Greely, Fifth Cavalry, acting signal officer and assistant to the Chief Signal Officer, is hereby assigned to the command of the expedition, and is charged with the execution of the orders and instructions given below. He will forward all reports and observations to the Chief Signal Officer, who is charged with the control and supervision of the expedition.

In addition to the persons named above, Mr. Henry Clay, accompanies the expedition as volunteer secretary to the officer commanding. Mr. Clay with Dr. Pavy spent the winter in Greenland preparing themselves for work further north.

THE INSTRUCTIONS:

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
WASHINGTON, D. C., June 17, 1881.

INSTRUCTIONS NO. 72.

The following general instructions will govern in the establishment and management of the expedition, organized under Special Orders, No. 97, War Department, office of the Chief Signal Officer, Washington, D. C., dated June 17, 1881: The permanent station will be established at the most suitable point north of the eighty-first parallel and contiguous to the coal seam discovered near Lady Franklin Bay by the English expedition of 1875. After leaving St. Johns, N. F., except to obtain Esquimaux hunters, dogs, clothing, etc., at Disco or Upernavik,

only such stops will be made as the condition of the ice necessitates, or as are essential in order to determine the exact location and condition of the stores cached on the east coast of Grinnell Land by the English expedition of 1875. During any enforced delays along that coast it would be well to supplement the English depots by such small caches from the steamer's store of provisions as would be valuable to a party retreating southward by boats from Robeson's Channel. At each point, where an old depot is examined or a new one established, three brief notices will be left of the visit; one to be deposited in the cairn built or found standing; one to be placed on the north side of it, and one to be buried twenty feet north (magnetic) of the cairn. Notices discovered in cairns will be brought away, replacing them, however, by copies. The steamer should, on arrival at the permanent station, discharge her cargo with the utmost dispatch and be ordered to return to St. Johns, N. F., after a careful examination of the seam of coal at that point has been made by the party to determine whether an ample supply is really procurable. A report in writing on this subject will be sent by the returning vessel. In case of doubt an ample supply must be retained from the steamer's stores. By the returning steamer will be sent a brief report of proceedings and as full a transcript as possible of all meteorological and other observations made during the voyage. After the departure of the vessel the energies of the party should first be devoted to the erection of the dwelling house and observantories, after which a sledge party will be sent, according to the proposal made to the Navy Department, to the high land near Cape Joseph Henry. The sledging parties will generally work in the interests of exploration and discovery. The work to be done by them should be marked by all possible care and fidelity. The outlines of the coasts entered on charts will be such only as have actually been seen by the party. Every favorable opportunity will be improved by the sledging parties to determine accurately the geographical positions of all their camps and to obtain the bearing therefrom of all distant cliffs, mountains, islands, etc. Careful attention will be given to the collection of specimens of the animal, mineral and vegetable kingdoms. Such collections will be made as complete as possible; will be considered the property of the Government of the United States, and are to be at its disposal. Special instructions regarding the meteorological, magnetic, tidal, pendulum and other observations, as recommended by the Hamburg International Polar Conference, are transmitted herewith. It it contemplated that the permanent station shall be visited in 1882 and 1883 by a steam sealer or other vessel, by which supplies for and such additions to the present party as are deemed needful will be sent. In case such vessel is unable to reach Lady Franklin Bay in 1882, she will cache a portion of her supplies and all of her letters and dispatches at the most northerly point she attains on the east coast of Grinnell Land, and establish a small depot of supplies at Littleton Island. Notices of the locality of such depots will be left at one or all of the following places, viz: Cape Hawks, Cape Sabine and Cape Isabella. In case no vessel reaches the permanent station in 1882 the vessel sent in 1883 will remain in Smith's Sound until there is danger of its closing by ice, and, on leav-

ing, will land all her supplies and a party at Littleton Island, which party will be prepared for a winter's stay, and will be instructed to send sledge parties up the east side of Grinnell Land to meet the party. If not visited in 1882, Lieutenant Greely will abandon his station not later than September 1, 1883, and will retreat southward by boat, following closely the east coast of Grinnell Land until the relieving vessel is met or Littleton Island is reached. A special copy of all reports will be made each day, which will be sent home each year by the returning vessel. The full narrative of the several branches will be prepared with accuracy, leaving the least possible amount of work afterward to prepare them for publication. The greatest caution will be taken at the station against fire, and daily inspections made of every spot where fire can communicate. In case of any fatal accident or permanent disability happening to Lieutenant Greely, the command will devolve on the officer next in seniority, who will be governed by these instructions.

The Lady Franklin Bay Station will form the initial one of the International series, in which the future coöperation of the principal European nations is expected.

THE POINT BARROW EXPEDITION.

This Expedition, like the one to Lady Franklin Bay, is sent out by the War Department, and is under the supervision of the Signal Office. It is designed for permanent work and forms one of the International series of Arctic Stations established by the United States.

A schooner, named the "Golden Fleece," has been chartered in San Francisco to transport the party and supplies to Point Barrow, and then return to the United States.

The following instructions to the commanding officer, give the personnel of of the expedition, and the nature of the proposed work:

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
WASHINGTON, D. C., June 24, 1881.

By direction of the Secretary of War, the following named officers, civilians and enlisted men, are assigned to duty as the expeditionary force to Point Barrow, Alaska Territory, viz: First-Lieutenant P. Henry Ray, Eighth Infantry, acting Signal Officer; Acting Assistant-Surgeon George Scott Oldmixon, U. S. Army; Sergeant James Cassidy, Signal Corps, U. S. Army, Observer; Sergeant James Murdock, Signal Corps, U. S. Army; A. M. Harvard, Naturalist and Observer; Sergeant Middleton Smith, Signal Corps, U. S. Army, Naturalist and Observer; Captain E. P. Herendeen, Interpreter, storekeeper, etc.; Mr. A. C. Dark, Astronomer and Magnetic Observer (coast survey); carpenter, cook and laborer.

First-Lieutenant P. H. Ray, Eighth Infantry, acting Signal Officer, is hereby assigned to the command of the expedition, and is charged with the execution of

the orders and instructions given below. He will forward all reports and observations to the Chief Signal Officer, who is charged with the control and supervision of the expedition.

As soon as practicable, Lieutenant Ray will sail with his party from San Francisco for Point Barrow, lat. 71° 27′ N., long. 156° 16′ W. (Beechey), and establish there a permanent station of observation, to be occupied until the summer of 1884, when he will return here, unless other orders reach him. On the way out and back a stoppage of a few days only will be made at Plover Bay (lat. 64° 22′ 0″ N., long. 173° 21′ 32″ W.) for the purpose of determining the error and sea rate of his chronometers. The vessel conveying him to his destination will not be detained at the permanent station longer than is necessary to unload the stores.

The general instructions to Lieutenant Ray are the same as given to Lieutenant Greely, of the Lady Franklin Bay Expedition. He is ordered to send his vessel back to San Francisco as soon as possible with a report of the latitude and longitude of his station, and a transcript of observations made on the voyage. Careful attention to the making of animal and vegetable collections is required. It is contemplated that the permanent station shall be visited in 1882, 1883 and 1884 by a steam or sailing vessel, by which supplies for, and such additions to the present party as are deemed needful will be sent. List of stores required to be sent by the next season's vessel, will be forwarded by each returning boat. The subject of fuel and native food-supply, its procurement and preservation, will receive full and careful attention, as soon after the establishment of the post as practicable. Full reports upon this subject will be expected.

The party is expected to leave San Francisco July 15th.

THE JEANNETTE OR BENNETT EXPEDITION.

The steamer Jeannette, owned and equipped by Mr. James Gordon Bennett, of the New York *Herald*, but officered and manned, under a special act of Congress, by the U. S. Navy Department, sailed from San Francisco for the Arctic, via Behring's Strait, July 8, 1879.

The Jeannette was provisioned for a three years cruise, or until October, 1882, until which time no serious apprehension for her safety need be experienced. The vessel was officered as follows:

Lieutenant G. W. DeLong, Commanding; Lieutenant C. W. Chipp, Ex. Officer; Lieutenant J. W. Danenhower, Navigator; G. W. Melville, Chief Engineer; J. W. Ambler, Passed Assistant Surgeon; J. J. Collins, Meteorologist; R. L. Newcomb, Naturalist.

At St. Michaels, Alaska, the Jeannette took on board dogs, sledges, drivers and fur clothing, and then passing through Behring's Strait was last seen September 2, 1879, about ten miles south of Herald Island by Captain Barnes, of the American Whaler Sea-Breeze. On the following day the smoke of a steamer supposed to be the Jeannette was seen near Herald Island by several whalers, but

the vessel itself was not seen. Since that date nothing is known of either vessel or crew, but there appears to be no valid reason for doubting their safety.

After leaving San Francisco, De Long wrote under date of July 17, 1879, "In the event of disaster, we shall retreat upon the Siberian settlements or endeavor to reach natives around East Cape, and wait for a chance to get back to our depot at Saint Michael's. If a relief ship comes up to merely obtain tidings of us, let her look farther on the east side of Wrangel Land, and on Herald Island. If I find we are being carried eastward, *against our efforts to get north*, I shall try to push through into the Atlantic by way of the east coast of Greenland, if we are far enough north; but if we are far south, then by way of Lancaster Sound and Melville Bay."

Captain De Long wrote to his wife at sea, under date of August 17, 1879, that he proposed to proceed north by the way of the east coast of Wrangel Land, touching at Herald Island, where he should build a cairn and leave records, thence landing on Wrangel Land, he should leave records on its eastern coast under cairns at about twenty-five miles apart.

In this connection the following letter from Lieutenant De Long will be of interest:

ARCTIC STEAMER "JEANNETTE,"
AT SEA, Lat. 49° 24′ N., Long. 152° 37′ W.

Capt. H. W. Howgate, U. S. A., Washington, D. C.:

MY DEAR SIR,—Until now, I have had no chance to supplement my telegraphic thanks for your generous contribution of fur clothing, by a word in writing. I desire to thank you in behalf, not only for myself, but of Mr. James Gordon Bennett, who authorized me to accept them for the expedition with his thanks.

Should we meet next year among the floes of the Arctic, we shall be only too glad to share not only *your* clothing but *our* food with our brethren of the Army, and to unite our energies with theirs in planting our flag at least one stage nearer the Pole. Very sincerely yours,

(Signed), GEORGE W. DE LONG,
Lieut. Commanding.

THE "CORWIN" EXPEDITION.

Last year, the Revenue Cutter "Corwin," Captain Hooper commanding, was sent by the Treasury Department on a cruise in Behring Sea and the Arctic Ocean, to search for traces of two missing whalers, the Vigilant and Mt. Wollaston, and incidentally for news of the "Jeannette." Capt. Hooper failed in the principal objects of his mission, but did such excellent work that the Department determined to send him again this year.

The following is a copy of the instructions forwarded to Capt. Hooper:

WASHINGTON, April 21, 1881.

Capt. C. L. Hooper, Commanding Revenue Steamer Corwin, San Francisco, Cal.:

SIR,—The Department having determined to despatch the Revenue Steamer Corwin under your command to cruise in the waters of Alaska for the enforcement of the provisions of law and protection of the interests of the government on the seal islands and the sea otter hunting grounds and Alaska generally, you are directed to take on board that vessel without delay supplies of provisions for a six months' cruise, and sufficient quantities of fuel and water, and leave San Francisco with your command not later than the 1st *proximo* for the waters named and make the best of your way to the places hereinafter designated. It is desirable that you should be in Behring Sea and the Arctic Ocean as early in the season as the opening of navigation will permit. You will accordingly proceed from San Francisco direct to Ounalaska and on arrival there will take in a fresh supply of coal. From this point you will proceed to the Arctic Ocean, touching at the Seal Islands and at St. Michael's, if practicable, on your way. You will leave an officer and two men on Otter Island for the purpose of protecting the seals there, unless, after conferring with the special agent in charge of the Seal Islands, you should deem it necessary to take all your command with you in your further cruise to the northward. Should you enter Norton Sound, it is expected you will time the movements of your vessel, so as to arrive in those waters before Behring Straits are open for the passage of vessels. Following the instructions for your cruise of last year, governing the illicit traffic with the natives by unauthorized parties, in fire-arms, ammunition and distilled spirits, you will use your utmost endeavors to apprehend any vessels you may find engaged in such illicit traffic and break up their illegal trade.

No information having been received concerning the fate of the whalers, Mt. Wollaston and Vigilant, you will bear in mind the instructions for your cruise of last year, and it is hoped you may bring back some tidings of the missing vessels.

You are further instructed, while in the Arctic, to make careful inquiries regarding the progress and whereabouts of the steamer Jeannette, engaged in making explorations under the command of Lieutenant Commander De Long, U. S. N., and you will, if practicable, communicate with, and extend any needed assistance to, that vessel.

Should you be able to accomplish your mission in the Arctic Ocean early in the season, or find it necessary in carrying out these instructions to return to the Seal Islands before the usual time (say October 10th), for the return of the Revenue Steamer from those waters, you will make a cruise to the westward from Ounalaska as far as Altou, with the general object of protecting the sea otter in hunting grounds and breaking up the business of the illicit traders. You will, in your season's cruise, touch at such places as may be practicable on the main land or islands where there are settlements of natives, and examine into and report upon their condition.

You are permitted, in your discretion, to remain in the Arctic Ocean as late in the season as may be necessary to accomplish the object of your voyage without encountering undue hazard to your command.

While cruising in the Arctic Sea, you will make careful observations as to currents, tides, &c., and will keep an accurate record of such soundings, surveys, &c., as you may be able to make, and you will obtain such information as may be practicable regarding the numbers, character, occupations and general condition of the inhabitants of the adjacent coasts.

It is hoped that in your Arctic cruise you may be able to make use of coal from the mines located and opened by you last season, and you are authorized, should you deem it advisable, to ship, in the capacity of ordinary seamen, two or three persons skilled in coal mining, whose services you may make use of in getting out a supply from the mines above mentioned. You are also authorized to purchase any implements which may be necessary for the purpose.

Previous to sailing from San Francisco, you will forward to this department a muster and descriptive roll of officers and men of your command. You will, whenever opportunity presents, transmit to the department reports of the progress of your cruise.

In conclusion, the department, having defined the general objects of your voyage and relying upon your skill and good judgment, confides to your discrecretion the details of your cruising within the Arctic Ocean, and takes pleasure in wishing you a prosperous voyage and a safe return.

Very respectfully, WILLIAM WINDOM,
Secretary of the Treasury.

The Corwin sailed from San Francisco May 4th, officered as follows:

Captain, C. L. Hooper, Boston; 1st Lieutenant, W. J. Herring, New York; 2nd Lieutenant, E. Burke, Milwaukee; 3rd Lieutenant, O. B. Myrick, Boston; 3rd Lieutenant, George H. Doty, New York; 3rd Lieutenant, William E. Reynolds, Washington; Chief Engineer, James T. Wayson, Baltimore; 1st Assistant Engineer, Charles A. Lawes, Philadelphia; 2nd Assistant Engineer, Frederik E. Owen, Oswego, N. Y.; Surgeon, I. C. Rosse, Washington.

She is provisioned for a nine month's cruise, but if Captain Hooper decides to winter in the Arctic he will be furnished with additional supplies by the Alaska Commercial Company.

The Corwin reached Ounalaska, May 17th, and sailed thence for the Arctic, after making a few needed repairs, May 22nd.

THE RODGERS OR JEANNETTE SEARCH EXPEDITION.

The bill making appropriations for Sundry Civil Expenses of the Government, for the fiscal year ending, June 30, 1882, contained the following clause:

To enable the Secretary of the Navy to immediately charter or purchase, equip, and supply a vessel for the prosecution of a search for the steamer Jeannette of the Arctic Exploring Expedition (which the Secretary of the Navy is

hereby authorized to undertake), and such other vessels as may be found to need assistance during said cruise, one hundred and seventy-five thousand dollars: Provided, That said vessel shall be wholly manned by volunteers from the Navy.

As soon as practicable after the passage of this act, the Secretary of the Navy convened a board of naval officers to consider the directions of the search, the means best adapted for it, and the details of the search expedition when ordered.

The following is the report of the board:

WASHINGTON, March 26, 1881.

Hon. William H. Hunt, Secretary of the Navy:

SIR,—The "Jeannette" Relief Board has the honor to make the following report in regard to the matters embraced in your instructions of the 10th inst. You refer three main objects to the consideration of the Board.

First, The direction of the search. To ascertain the direction of the search it is proper to find where the "Jeannette" proposed to go. The captain, in a letter to his wife, written at sea, August 17, 1879, said that he proposed to proceed north by the way of the eastern coast of Wrangel Land, touching at Herald Island, where he should build a cairn and leave records, thence landing on Wrangel Land and leaving records on the eastern coast under cairns at about twenty-five miles apart.

While in pursuance of this plan apparently he was seen by the whaler "Sea Breeze" on the 2d of September, 1879. Captain Barnes, in command of the "Sea Breeze," said she was about fifty miles south of Herald Island. The vessels were only about six miles apart. The sea was comparatively clear of ice where the "Sea Breeze" was, but the "Jeannette" was seen entering a lead or channel through thick ice, steering up toward Herald Island. Next day thick, black smoke was seen to be issuing from her smoke-stack, but the hull was invisible below the horizon. The "Jeannette" left San Francisco with anthracite coal, but at Ounalaska took in 150 tons of bituminous coal.

The whalers "Vigilant" and "Mount Wollaston" were last seen October 10, 1879, about eighty miles northeast by east from the spot where the "Jeannette" was seen on October 2 and 3, 1879. The "Mount Wollaston" and "Vigilant" were together. The "Mercury" and the "Helen Mar" were near them.

The two first named vessels sailed off to the northwest; the other two did not change their place. In a few hours the ice, under the influence of a sudden change of temperature, owing to a northwest breeze, began making and grew so fast that in twelve hours it had become some six inches in thickness. The "Mercury" and "Helen Mar" recognized their danger. The crew of the "Mercury" abandoned their vessel and went on board the "Helen Mar" as the newer and more able vessel, and in her the crews escaped to clear water, after sailing some sixty miles through ice. The "Mercury" has not since been seen.

Harper's Monthly for September contains the following articles: The Little Kings and Queens—a poem; The English at the Sea-side; To-morrow at Ten; A Newport Idyl; Summering Among the Thousand Isles; The Widow Lee's Son, Will—a poem; The Girl's Sketching Camp; An Old Fort and What Came of It; On Star Island—a poem; The Framing and Hanging of Pictures; An Artist's Reminiscences—II Adoniram Algeroy; Wheat Fields in the Northwest; At Deacon Twombly's—a story; The German Empire; The Chances of War, and How it Was Missed; The Chamber of Silence—a poem; A Laodicean. The number is fully up to the standard. "Summering Among the Thousand Isles" reads like a fairy tale, and might be called a prose poem. Lotos Land is the American Elysium for summer tourists. "The Chamber of Silence" finds an echo in the heart. "An Old Fort and What Came of It" will be read with a deep interest as being the unfolding historical germ of William's College where Mark Hopkins has enriched the world by a life devoted to the highest interests of man.

THE contents of the *Atlantic Monthly* for September are as follows: Dr. Breen's Practice; Kashchie the Deathless, or the Diffusion of Fairy Tales; Harvest Noon; Housekeeping Hereafter; The Portrait of a Lady; Post Prandial; The Katrina Saga; The Future of Harvard Divinity School; The Dramas of the Elder Dumas; The Attempt on the President's Life; Mr. Howell's New Book; The Rise and Fall of the Confederate Government; Some Recent Biographies; The English Colonies in America; Transcendental Physics; The Contributor's Club. One can always afford to buy the *Atlantic* and take his chances. The present number is thoughtful. We learn that Harvard's Divinity School will "aim at retaining a positively Christian, while it avoids a specifically denominational character." The review of Mr. Howell's New Book will attract attention.

THE *North American Review* for September has the following articles: The Church, the State and the School; Natural Ethics; The Monroe Declaration; Shall Church Property be Taxed? Jewish Ostracism in America; The Decay of New England Thought; Ghost-Seeing and Factitious History. The leading article by W. F. Harris, finds five provinces which include all human education, viz: The Family, the School, Civil Society, the State and the Church. Each one has its distinctive work, the article relegating our ethical training to the church. The article is clear and forcible, and will be widely read.

THE *American Journal of Science* for August contains twelve papers with a large amount of scientific intelligence. The papers of this standard journal are based on original observation and experiment and it is refreshing in reading it to come face to face with Nature. This journal for many years has done honor to American science.

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The "Mount Wollaston" and the "Vigilant," with their crews, numbering about thirty people each, have not since been heard from. They were in full probability caught in the ice, which formed so suddenly around the other vessels, and did succeed in breaking their way out.

The meteorological records of the Arctic for 1879, though not complete, show that in September and October strong gales prevailed, such as would render very perilous the situation of vessels caught in the pack ice and protected by no harbor. Captain Cogan saw a very heavy pack, he thought one hundred feet thick, through which the missing vessels would have to make their way and against which they would have to defend themselves, unless they were fortunate enough to get into some harbor. Against such immeasurable force as thick pack ice, driven by a current, skill in handling a vessel would avail nothing. The ship would be carried with the ice. No floating structure made by man could resist it, and, as the coast was encumbered with ice, there seems little probability that they made a harbor. But in case the vessels were lost the crews might make their way over the ice to Wrangel Land, where only they can be sought, since the Arctic is too vast to be explored with any rational hope of success in finding the vessels, except upon some definite information as to whither they were driven.

But the information of the purpose of Captain DeLong to land on Wrangel Land is very definite. He proposed to land there frequently and to build cairns. On Wrangel Land, then, and on Herald Island, where he proposed to go, information of him is to be sought.

Captain Cogan said before the Board that the "pack ice around Herald Island was such as would keep the 'Jeannette' from landing, since, even though they succeeded in sending parties over the ice, it would take them a good while, their vessel would be drifting off all the time and they could not get back. They could not steam back and hold their place; they could not hold up against that ice. The 'Jeannette' was in the ice and going along with it. It enclosed her, for she steamed right into it. I do not think it would be proper to send people away from her, as they might not be able to get back."

From all the foregoing it does not seem probable that cairns will be found on Herald Island, and we fear scarcely on Wrangel Land. It will be proper to look for them, however.

"In the event of disaster to the ship," says Captain De Long, in his letter of July 17, 1879, after leaving San Francisco, "we shall retreat upon the Siberian settlements or the natives of around East Cape, and wait for a chance to get back to our depot at St. Michaels. If the ship comes up merely for tidings of us, let her look further on the east side of Kellett Land and on Herald Island. If I find we are being carried east against our efforts to get north I shall try to push through into the Atlantic by way of the east coast of Greenland if we are far enough north, and if we are far south, then by way of Lancaster Sound and Melville Bay."

Captain Cogan, who has a very high reputation for experience and intelligence in Arctic matters, saw the pack ice into which the "Jeannette" had gone

the day before his arrival. He estimated its thickness at about one hundred feet. He said the current had already commenced running northwest at the rate of about twenty miles a day, and this current was carrying the ice in the same direction. Captain Cogan's remarks are worth quoting: "There appears to be a strait between Wrangel Land and some land to the northeast that forms a kind of sluice-way, and when there is ice on both sides there will be a little stretch where the current runs about twenty miles a day, so that in whaling we have to run south every day after that hole opens, to hold our position. In cutting in a whale to the south coast of Herald Island, I found we were drifted twenty miles to the northwest. If you get further to the eastward of Herald Island, you get out of this current."

He says: "I did not see the smoke of the 'Jeannette.' I was there when they reported smoke, but I did not call it smoke. I think it was frost rising from the holes in the ice. There were twenty different places where it looked as if smoke was rising. I did not call it smoke, but it might have been."

The smoke, however, is unimportant. The captain of the "Sea Breeze" saw the "Jeannette" the day before the smoke was reported. Nor would a whaling captain mistake the "Jeannette" steamer, plainly seen, for a whaler. What the captain of the "Sea Breeze" saw, was undoubtedly the "Jeannette." Her smoke was reported, on the 6th of September, further north than when seen by the "Sea Breeze;" but if this was really her smoke it only proves that she was still going to Herald Island, which we should naturally assume without proof.

As preliminary work, the "Mary and Helen" should visit Petropaulovsky for Arctic clothing, for dogs, sledges and dried salmon for dog food. Thence to St. Michaels, to St. Lawrence Bay, to East Cape, to Cape Serdge Kamen, to Kumotschin Bay for tidings of the "Jeannette," to Herald Island; thence to the southeast coasts of Wrangel Land for cairns or other notices and to examine the harbors for wintering quarters on the south or southwest of Wrangel Land or in Siberia near some Tchuktchi village.

To give time for visiting the various places named the "Mary and Helen" should leave San Francisco about June 1st, so as to arrive at Herald Island near the middle of August, for it does not appear that any earlier arrival will be useful. It is only late in the season that the ice leaves Wrangel Land.

Congress, it appears, had no will to risk another exploring vessel. (See Commodore Jeffers' letter appended.) The "Mary and Helen" should not be caught in the ice away from a harbor, except from accident beyond control. If she winters on the southeast coast of Wrangel Land or on the southern shore she would easily return home next year, after having usefully spent her time available for the purpose in examining the coast by means of sledge journeys.

Second, "The means best adapted to the search."

The available means best adapted to the search is the employment of the "Mary and Helen," fully officered, thoroughly supplied with stores and the ne

essary appliances, such as sledges, with twenty-five dogs in all, with natives to drive them.

The "Mary and Helen" is new, strong, and has a speed of eight knots under steam and is faster under canvas. It is believed that the "Mary and Helen" is the only fit vessel which could be procured in time for the search after the appropriation was made.

It would have been better, perhaps, had the propeller been made to hoist and the rudder to unship readily, but special provision had been made for strengthening these parts, so that in practice the "Mary and Helen" is the very best means within reach of the Government. She was specially built for Arctic navigation.

Third, "The details of the search expedition."

The details have been carefully considered and will be found in the appendix, giving ample clothing lists, the Navy ration for two years, with other food added, amounting in all to supplies which can be made to last three years, with suggestions from the Surgeon-General of the Navy in regard to scurvy, snow-blindness and such other matters as occur to him as useful.

Suggestions are added by the Board to guide the shipping officer in the physical selection of fit men for the peculiar service.

A list of medical supplies, a list of articles for trade with the natives, an officer list and a crew list are also included.

It would be advantageous, probably necessary, to have coal (say 200 tons) landed at St. Michaels to fill up the vessel previous to entering the Arctic circle. At St. Michaels the Signal Service will have a meteorologist stationed, and the Alaska Fur Company have there a trading station.

A letter should be obtained from the Russian government, either through the Russian minister at Washington or through our minister at St. Petersburg, so that the necessary facilities may be extended from the commanding officer in Petropaulovsky to the captain of the "Mary and Helen," the better to enable him to make such purchases as he may desire for the purposes of the expedition.

Dogs and sledges have been mentioned in the outfit, with a couple of drivers from Petropaulovsky and some natives from the Tchuktchis as drivers, as hunters and as men experienced in traveling over ice.

The drawing made by Captain Thomas Long, of the bark "Nile," of Cape Hawaii, on the coast of Wrangel Land, indicates a formation of outlying islands, making fiords inside of them. Captain Cogan speaks of "quite a harbor on the southeast end. Whether this southeast end is an island or a deep bay, like St. Lawrence Bay, I am not sure."

Accordingly, some harbor on the southern or southeastern end of Wrangel Land has been selected as offering far greater advantages than any other for examining the locality where the people of the "Jeannette" and of the missing whalers are to be sought if their vessels have been abandoned." But failing in this purpose of getting into such harbor, the "Mary and Helen" should find some secure place in Siberia for wintering as near to Wrangel Land as is possi-

ble, for the purpose of making sledge journeys on the coast of Wrangel Land, if it be possible to cross the strait.

The sledge journeys, from what we can learn of the ice which fringes Wrangel Land, seem the most ready means of carrying out the purpose of the expedition —namely, that of succoring the "Jeannette" and the whalers' people, without inordinate risk of losing the vessel sent to help them.

The mission of the "Mary and Helen" will be finished when she has examined the points indicated and has extended what help can be given and obtained, by means of sledge journeys, all the information which can be had of the missing people and vessels. She is not to winter in the Arctic except to promote the search for which she is sent out, nor then, except in a secure harbor: nor is she to remain more than one winter away from home. Whatever instructions may be given, it should be clearly understood that much must be left to the judgment of the commanding officer. It is impossible to foretell the exigencies which may arise and which may demand other action than that which has been provided for.

In conclusion, the Board would add that the whole history of Arctic exploration is marked by great dangers, by wonderful escapes, by success where appearances forbade any rational hope. We will believe that the "Jeannette" and her gallant crew are safe until we shall know that disaster has occurred. In the North men are full of energy and courage, and so far necessity for action has never failed to bring forth daring skill, nearly always with admirable results.

We have the honor to be your obedient servants,

JOHN RODGERS,
Rear-Admiral and Prest. of the Board.

JAMES A. GREER,
Captain U. S. Navy, member.

A. S. KENNY,
Paymaster U. S. Navy and member.

J. H. KIDDER,
Surgeon U. S. Navy and member.

H. C. WHITE,
Lieut-Com'der U. S. Navy and member.

WM. P. RANDALL,
Lieutenant U. S. Navy and member.

R. M. BERRY, Lieutenant U. S. Navy, member and Recorder.

The department, having no ship available, purchased the steam whaler Mary and Helen, then lying in San Francisco harbor, paying for it the sum of $100,000. The name of the vessel was formerly changed to the Rodgers, and it was sent to the Man Island Navy Yard for equipment and outfit, under the supervision of Lieutenant R. M. Berry, who had been assigned to the command of the expedition.

In connection with the price paid for the vessel, the following letter from her builders will be of interest:

OFFICE OF GOSS, SAWYER & PACKARD,
SHIP BUILDERS,
BATH, MAINE, September 30, 1879.

Captain H. W. Howgate, U. S. A., Washington, D. C.:

DEAR SIR,—In reply to your esteemed favor of September 10th, would say that it would cost (independent of engines and machinery) to build a similar vessel to the steam whaler Mary and Helen, $17,000, complete.

The engines and boilers would probably cost $8,000. Owing to advance in price of materials and labor, we have had to advance in our prices for building.

Yours very truly,

(Signed), GOSS, SAWYER & PACKARD,

P. S.—Your letter did not reach us until last evening. G. S. & P.

The following brief instructions were given Lieutenant Berry by the Secretary of the Navy, under date of May 20, 1881:

"You will pursue as nearly as practicable the course recommended by the Board of which Rear Admiral John Rodgers was President, for the search you are about to undertake. You will report to the Department your progress and the condition of your vessel and command, by every available channel of communication during your voyage, making your reports as full and detailed as practicable. In the pursuit of your adventurous and arduous voyage, you carry with you the sympathy and entire confidence of the Department. Nothing that can be done to contribute to your well-being and success shall be omitted. As soon as you are ready you will sail. The eyes of your fellow-countrymen, and of the scientific men of all the world, and especially of those interested in Arctic explorations, will follow you anxiously in your way through the unknown seas to which you go. May Heaven guard and bless you, and your officers and men, and crown your heroism with success and glory.

Very respectfully W. H. HUNT,
Secretary of the Navy."

The Rodgers dropped down to San Francisco from Man Island on June 6th, and on the evening of that date, her officers were given a brilliant reception by the California Academy of Sciences, when papers were read by Mr. Charles Wolcott Brooks and Mr. James Gamble, and remarks made by Lieutenant Berry, Professor Davidson and Captain Howgate.

The occasion was a pleasant one, and the members present evidenced the deep interest taken on the Pacific coast in the subject of Arctic Exploration.

The Rodgers was delayed for several days waiting for the arrival of a portion of her supplies and a change in her personnel, made necessary by the illness of one of the officers, but finally sailed on June 16th, officered and manned as follows:

Lieutenant Robert M. Berry, U. S. N., Commanding; Howard Scott Waring, Master, U. S. N., Executive Officer and Navigator; Dr. Meredith Dabney

Jones, U. S. N., Passed Assistant Surgeon; Charles W. Putnam, Master, U. S. N.; Abraham V. Zane, U. S. N., Passed Assistant Enginees; Henry Jackson Hunt, U. S. N., Ensign; George Middleton Stoney, U. S. N., Ensign; Dr. Joaquim Demetrius Castillo, U. S. N., Assistant Surgeon; Colonel Wm. H. Gilder, Pay Clerk, and New York *Herald* correspondent, (was with Lieutenant Schwatka's expedition to King William's Land); Joseph Hodgson, Paymaster's yeoman and storekeeper, Scoby Willard Morrison, Geo. Gardner, Jr., Patrick Cahill, machinists; Herbert P. de Tracy, acting carpenter. Also, one steward, two cooks, three firemen and fifteen ablebodied seamen.

The vessel is provisioned for four years, and bountifully supplied with reading matter.

THE ALLIANCE SEARCH FOR THE JEANNETTE.

The U. S. S. Alliance, under date of May 27th, was ordered to be prepared with all dispatch to proceed on a cruise in search of the "Jeannette," between Greenland, Iceland, and the coast of Norway, and as far as the northern coast of Spitzbergen, if it is possible to get there without endangering the vessel. Before sailing the bow of the Alliance was encased with live oak, two inches thick, extending from the stem thirty-five feet aft, with a strong iron guard to protect the vessel against drift ice.

Her commander was directed to take a pilot at St. Johns, New Foundland, who was familiar with the coast of Iceland, and at Hammerfest, in Norway, one familiar with the coast of Spitzbergen; and again upon his arrival off the coast of Spitzbergen, to obtain from the walrus and seal hunters some one who can pilot the ship along that coast and into the best harbors. The Secretary says; "If the Jeannette should possibly get through from the direction anticipated she would probably sight Spitzbergen and make for the coast of Norway. You will therefore cruise backward and forward between Greenland and Spitzbergen as much as possible under sail" The vessel is not to remain longer than September 25th, not being fitted for Arctic exploration, but simply as a relief ship.

The Alliance under command of Commander Geo H. Wadleigh, sailed from Norfolk, Va., June 16th; reached St. Johns, N. F., June 24th, and sailed thence June 29th.

Belgium promises to become the great industrial teacher of Europe. Many foreigners are now attending her schools. She has fifty-nine technical schools, thirty-two industrial schools, and a higher commercial school—all receiving funds annually from the State.

PHILOSOPHY.

THE INFLUENCE OF MODERN SCIENCE UPON BELIEF IN MIRACLES.

BY C. C. KIMBALL, D. D., KANSAS CITY, MO.

This is an important and interesting topic. If, as is claimed, the tendency of modern science is to exalt natural law to a pitch of rigidity, who makes all miracles incredible, and reasonable people are to be denied the privilege of contemplating what they regard as the best authenticated fact in history—the resurrection of Christ—then Christianity is disproved, and the church of Christ certain to dissolve and perish.

Will the progress of scientific knowledge lead to this result?

To discuss a topic like this, without accurate definitions, is wasted labor. Without clear-cut definitions we are like persons standing on cloud capped mountains. We can see scarcely so far as our feet; but with the sharp definitions, the clouds are torn away and we can see both earth and heaven.

In order to understand the supernatural, we must first inquire

WHAT IS THE NATURAL?

It is that which God does by a usual, settled and regular procedure. It is the habitual way of God in the world about us. Unless God's methods were uniform, life would be confused and intolerable. If, for example, vaporizing water by heat would not always, but only occasionally, generate force, who would build a locomotive or a railway.

If water, falling on the wheel, would only now and then cause it to revolve, who would build the mill beside the rapidly descending stream?

If we did not know at any time whether fire would warm or freeze us, confusion would follow. But depending as we can on the settled ways of God, which we call the laws of nature—gravitation, heat, light and the like, we have a sure basis for industry and civilization.

WHAT IS THE SUPERNATURAL?

It is not God's settled and regular procedure, on which society and industry rest so securely, but his exceptional, unusual and special action in human affairs, interrupting for good reason the regular sequence of cause and effect. God was perfectly free to create the universe and assign to it fixed and regular laws. He is equally free, when he sees occasion, to break in upon the arrangement which he has adopted. To compare great things with small, a business man habitually walks to his office every morning. It is the habit or law of his life; but, one morning he breaks the law and goes down town in a carriage. He had satisfactory reasons for walking, and at last, he has equally satisfactory reasons for riding

Exactly so with God in the natural and supernatural, or what is the same thing, the habitual and the exceptional.

Generally, of course, he pursues one way, as we see would be best for his creatures, but sometimes his infinite wisdom inclines him to take another method and work what the scriptures call "signs and wonders." He works these miracles only when there is good reason for them, and when there is reason for them, none can prevent him.

But now we come to

A PSYCHOLOGICAL WONDER.

Certain men of materialistic pursuits, chiefly, tell us that they have taken a deep look into what they are pleased to call "Nature," and they do not see reason to believe that God can, in any way, interrupt the system which he has started. They have looked even with a microscope, and do not find a miracle possible. Some find no evidence of the existence of any God or possible interrupter of the universal system of law. Thomas Henry Huxley, for example, though he himself interrupts the law of gravitation every time he moves hand or foot, utterly rejects the statement that God did on one occasion cause an iron ax to swim upon the surface of a river.

Huxley could lift an ax above his head, but when he is told that Almighty God sustained an ax upon the surface of water, he says "impossible." In his New York addresses, he tells us that "the conception of the constancy of the order of Nature has become the dominant idea of modern thought." He begins the word nature with a capital "N." He remarks further, "To any person who is familiar with the facts, and competent to estimate their significance, it has ceased to be conceivable that events should depend upon any but the natural sequence of cause and effect." "The present is the child of the past and the parent of the future." "We ignore even as a possibility the notion of any interference with the order of Nature."

In a similar way Prof. Tyndall has come to regard Elijah on his knees praying for drought and rain, as only a "noble savage" ignorant of the principle of conservation of forces which he thinks destroys the possibility of a miracle. He has written to defend the sense-bound English clergymen who refused to take part in services of fasting and prayer on account of the calamity of a bad harvest. He concludes if free prayer can "produce changes in external Nature (capital N), it necessarily follows that natural laws are more or less at the mercy of man's volition, and no conclusion founded on the assumed permanence of those laws would be worthy of confidence. These are the insuperable difficulties presented to us. (1.) The principle of correlation of forces shuts out the possibility of supernatural interference. (2.) If God should work a miracle, the whole industrial and scientific world would forthwith be confused, and no scientific conclusion would be worthy of confidence.

Where now shall we seek for a brain sufficiently strong to refute these tremendous arguments? Who can liberate the Almighty from these adamantine chains of impossibility?

The logic of the difficulty resembles the famous proof that the minute hand of the clock can never overtake the hour-hand. At one oclock the minute-hand points to twelve, and the hour-hand to one. When the minute-hand reaches one, the hour-hand has advanced one-twelfth as much farther. When the minute-hand has traversed that one-twelfth the hour-hand has again advanced one-twelfth as much farther and so on forever. Therefore the minute-hand can never overtake the hour-hand.

I suppose it does not seem incredible that Omniscience should somehow be able to break from these toils of logical impossibility, which the students of physical science have woven.

Even though all the scientists should unitedly proclaim that God is subject to the laws of matter, a shackled prisoner, still we should remember that the Lion of the tribe of Judah opened the book with seven seals, and we should expect the Almighty to break the scientific ropes and chains, which these audacious philosophers are trying to put about him.

The Christian man is not frightened when he is told that God could never have taken Enoch alive to heaven, because, before he had risen to the height of seven miles, he would have been "frozen perfectly stiff." In spite of modern infidelity, cultivated Christian thinkers will still believe that Elijah could have reached heaven without a chariot of fire to help him through the cold.

Can the All-Powerful and All-Knowing God be stopped by a smart conundrum and chained by a logical fallacy?

THE GREAT CENTRAL MIRACLE

Of the universe is the Lord Jesus Christ himself. He is miraculous in his origin, miraculous in his birth, miraculous in his sinlessness and moral beauty, miraculous in his resurrection from the dead (the best attested of all historic facts), and miraculous in his ascension into heaven.

Either Christ was a miracle in these ways and a miracle worker, or he was an impostor.

It is not credible that any advance of physical science will lead the world to reject Jesus Christ as a fraud and impostor.

By the nature of the case, miracles, which are only needed as signs to confirm the mission of a moral teacher, cannot be very frequent. They can come only in those moral exigencies that require them, but then they *must* come. Then it would be unnatural not to find the supernatural.

THE TEMPORARY EFFECT

Of modern scientific infidelity, it need not be denied, is more or less, to weaken faith in the supernatural. The confident and thousand times repeated assertions of lecturers and editors, that modern science has undermined the Bible and the church, have produced a natural effect. The mind is so constituted as to be influenced by the din of repetition. The persistent cry has, no doubt in numerous instances, weakened faith, and consequently damaged morality.

Unbelievers have been strengthened in their convictions, and even some of God's own people have taken a temporary refuge in scientific doubts while they

have neglected duty and yielded to temptations, to unchastity, Sabbath-breaking, over-reaching in business, untruthfulness and the like.

THE REASONS WHY

Unbelieving scientists have been able to damage faith, are easy to find.

1. They have beforehand, *the natural heart predisposed to reject Christianity*— "the evil heart of unbelief," "the carnal mind which is enmity against God."

2. *The unpleasant stringency of God's laws stimulates unbelief.* When the Bible forbids a man to do what he very much wants to do, he is prepared to accept bold assertions that the Bible is a discredited book.

3. *The greatness and vagueness of the field of view*, help to damage faith. Very few, indeed, have time to examine for themselves long enough to form independent conclusions. The confident objector comes forward on the platform, or on the page of the review, and says "We have been investigating a region where you are utterly unable to follow us, and we have found that belief in a God is a foolish superstition. We have utterly demolished the credit of the scriptures and exploded the belief in miracles." Such bold assertions have more or less effect, and the din of incessant repetition has more effect still. Rabshakeh stands to-day outside the walls of Jerusalem, and blows his horn in the name of the Sennacherib of modern science, and calls aloud for surrender.

"Where are the gods of Hamath and Arpad? Where are the cave-dwellers and the anthropoid apes, and the orohippus and the mesohippus? Where are the Ornithocelidans and the Compsognathus Longipes? Toss your Bibles over the walls and turn your churches into theatres; for we are coming to baptize you in the slimy Bathybius, and the Lord is powerless to deliver you out of our hands." This Rabshakeh-talk has some effect for evil upon the unlearned.

4. *The foolishness of the saints* also is the cause of some of the mischief which we deplore. The actual and indisputable advances in scientific knowledge have often met among God's people, with stupid denial.

Exploded theories of the interpretation of parts of the Bible have been clung to as though the theories were the Bible itself. This stupidity has brought contempt on religion.

Some scientific conclusions should be accepted and joyfully welcomed, because they are settled and sure. Other conclusions ought neither to be accepted or rejected. Toward them we should take a "waiting attitude" until they come into a clearer light.

For example, it is stupid now to deny that there may have been in the origin of man, a sort of creative or theistic evolution. Whether true or not, the current of probability is running so strongly in that direction, that a stern and unvarying rejection of every form of that theory is bigoted and hurtful.

It is not wisdom to insist that every good Christian shall believe that the omniscient and wonderful Creator formed the body of Adam, as a child would

make a mud pie. There are thoughtful and reverent Christians—it need not be denied—who regard the theory of an abrupt creation of the human body as insufferably crude, and quite out of harmony with the usual methods of the Creator.

Evolutionism in some form may or may not be true. On that point I do not, in this paper, define my belief; but I do say that in these days it is hurtful and stupid to deny and oppose every theory of evolution. Many sincerely think a creative evolutionism must be admitted as the theory of Copernicus was admitted. To denounce such honest opinion is uncandid, bigoted and mischievous. It loses to faith many noble souls. But while just now the efforts of unbelieving scientists may in some respects be damaging to the church,

THE EVIL IS TRANSIENT.

It will soon pass away, for reasons like the following:

1. The scientific infidels *are by no means as learned and competent to overturn Christianity as they think they are.* A young mouse, born and bred in a wooden chest, one day climbed to the top, and looking out into the dim and dusty attic, remarked that never before had he supposed the universe to be so large as it then appeared to him. God's universe is larger than some scientists have perceived. It contains more facts than matter and motion. It is too soon, by at least a thousand years, for any scientific Samson to come out with the jaw-bone of a Megalosaurus to level all the churches to the side-walk.

2. The scientific faith-destroyers are *at war among themselves.* They are united only by hatred to the church of Christ and unbelief in the possibility of miracles. Otherwise they float on a foaming sea of speculation theory and extravagant disagreement. Moreover they are varying and changing from day to day.

3. Another reason why the evil effect of scientific unbelief will be transient is the fact that scientific infidels *ask men to believe incredible things.* Reasonable people cannot yet believe in the spontaneous generation of life, or that God is a slave to his own laws. It is too much, to ask us to admit that the brain secretes soul as the liver secretes bile; or that a beefsteak can be literally and exactly transmuted into a prayer.

Parents are asked to believe that their dead children are nothing but manure in the universe, and they turn in horror and pain to the dusty old Bible to see what it may teach. The faith-destroyers say, "throw away the Bible, because it is so hard to swallow the camel of supernaturalism," and then they ask you to swallow, not one camel, but a whole menagerie of camels, elephants, gorillas, saurians, rhinoceroses and whales. It is too much to ask. They will not go down.

4. *Bad fruit grows on the tree of scientific infidelity.* The people are getting impressions of the real value and effect of the new gospel, from what goes by the name of nihilism and communism.

The doctrines of the new gospel—conscience a changing product of evolution—no judgment after death and no judge to sit on a throne of judgment—no heaven—no immortality of personal existence—are found to be tending rapidly toward the destruction of morality and the extinguishment of civilization.

At first these results do not so clearly appear because the horrible doctrines do not immediately displace the settled Christian faith; but soon the tree will bear a heavy crop of communists, nihilists, assassins and leprous, lustful robbers, and the people will turn in horror to the sublime old Bible-morality, whose fruit is always wholesome and good.

5. Still further, the popular mind cannot *reject the testimony of Christians to supernatural experiences* in their lives. That Luther, Bunyan, Edwards, Whitefield, Wesley, Spurgeon, Moody and millions upon millions more, all agreeing perfectly in their soul-cheering testimony, are unworthy of belief will not be credited by sane and sober minds. The theory of probabilities makes it absurd.

IN CONCLUSION,

Therefore, we boldly predict that the end of this form of infidelity is at hand. Its decline has long since begun. While science advances, scientific infidelity will perish; and the form of the Almighty Creator, behind the material creation, will appear with ever increasing definiteness, grandeur and glory. Science and revelation (nature and the supernatural) belong together. The truths of science will surround supernaturalism as the cloud on Olivet surrounded the risen and glorified body of the Redeemer, and went heavenward with him. Science is the luminous cloud; the risen body of Christ is the miracle. Both together, they rise toward heaven and carry mankind with them.

ASTRONOMY.

COMETS.

BY W. W. ALEXANDER, KANSAS CITY.

They derive their name from a Latin word meaning hair, and are a singular class of celestial bodies (probably belonging to the solar system) from which long trains of light, called "tails," extend out, similar in appearance to hair streaming in the wind. When they are seen with the naked eye they consist of three parts *nucleus*, *coma* and *tail*; the different parts are not entirely distinct but blend into each other by insensible degrees.

The nucleus always appears the same, no matter what its position is relative to the earth and and sun *i. e.*, it presents no phases similar to the moon or planets. This proves the nucleus to be self-luminous, or of some transparent substance

through which the light of the sun can penetrate, and be seen on the side opposite to that which it first strikes. The coma and tail must be a very rare or thin substance, as the light from a sixth magnitude star is sufficient to penetrate and pass through it, where it is more than a million miles in extent; the star's position being the same as before, proving the density to be insufficient even to refract light.

Comets have, at different times passed very near the planets but have never been found to cause any perturbations or irregularities in their orbits, while their own were materially affected. Like the planets they move round the sun in conic sections, their orbits are in the form of an ellipse, parabola, or hyperbola. If an ellipse, the eccentricity is usually very great; those that move in this form of orbit return after a series of years; but those that move in parabolas, or hyperbolas, never return, but after wheeling about the sun once, will continue to recede into infinite space for ever, and may visit other systems and suns. When near the sun they move with great velocity, sometimes at the rate of twenty-four million miles a day. It is the observed velocity relative to its distance from the sun that enables astronomers to determine the form of the orbit; if at the distance of the earth its velocity is equal to 2,400,000 miles a day, it will move in a parabola, if it exeeds that velocity in a hyperbola, if less, in an ellipse.

In many cases the velocity is so near the rate stated that it is impossible to decide whether they will return or not, it is however, certain that their return will be delayed many centuries, and, perhaps, thousands of years.

The exact number of comets cannot be determined; over seven hundred have been observed and recorded. Many have doubtless visited our sun without being seen, reaching their perihelion in the day-time, or during cloudy weather. Arago calculates the number that have appeared, and will appear within the orbit of Uranus at 7,000,000; the same calculation extended to the orbit of Neptune would increase the number four-fold. In the opinion of Kepler, the celestial spaces are as full of them as the sea is of fish, only a small portion of them being within the range of telescopic vision.

Among the remarkable ones that have appeared may be mentioned Halley's, which was first observed on August 19, 1682, and remained visible about one month and disappeared. After Halley computed the elements of its orbit, he found by comparison that it must be the same one observed by Kepler in 1607, and that it moved in a very elliptic orbit, returning to the sun once in about seventy-six years. This comet again appeared and passed its perihelion March 12, 1759; by adding seventy six years we find it should appear in 1835, and so it did, being first observed on August 5th; it approached the sun and passed its perihelion on November 16th at 11 o'clock a. m., only three days after the time predicted by De Pontecoulant, a French mathematician. It was followed until May 17, 1836, when it disappeared from view aided by the most powerful telescopes; but an astronomer can follow its course with the eye of science, which is almost as certain as ocular demonstration.

Biela's is another remarkable one of this elass of celestial objects. Being observed several times it was found to have a periodic time of six years and eight months. In the latter part of the year 1845 it was expected, and appeared, as usual, nothing remarkable being noticed, but in January, 1846, the astronomers of the Washington Observatory found it had separated into two distinct parts. At first one part was faint, but in about a month its brightness had increased so as to equal that of its companion. They disappeared in April, the amount of separation being about 200,000 miles. It was next due in 1852, and was looked for with great interest; when found, it was still divided only to a greater extent than in 1846, the space having increased to 1,500,000 miles.

This twin comet passed out of view on the 29th of September, 1852, and has not since been seen, time enough having passed for them to make four revolutions. At the return, due in 1872, the earth was in a very favorable position to see them, but they appeared not. They had seemingly vanished. As the earth passed through the orbit it encountered a small shower of *meteors;* which were probably a part of the lost comets.

Another bright comet appeared in 1843; the most careful investigation of its motion indicates that it will return in 530 years. Donati's; this great comet first appeared in 1858; it attained its maximum brilliancy in October.. Its tail then measured 40° in length 10° in breadth; observations showed its orbit to be elliptical, and that it will appear again about the year 3808.

Comets were formerly regarded with superstitious terror, as precursors of famine, war, and other misfortunes. In more modern times the fear of a collision made them dreadful objects. This fear has been dispelled by the discovery of their great rarity. A collision might be fatal to the comet, but could do no injury to a solid body like the earth.

On June 26, 1881, I observed a comet in the north west, its right ascension was 6 h. and declination 60° north; the tail measured 7° in length and 1° in width. The direction of its motion was north and west, nearly at a right angle to the ecliptic. It occupied the position of a circumpolar star and was above the horizon all the time. When last observed, July 12th, its polar distance was 8°; the tail I could not measure, owing to the moon being too near full. This is known as Comet "B" of 1881.

THE COMET OF 1881.

TRANSLATED BY CAPTAIN J. M. TROWBRIDGE.

When the last light of daylight has disappeared, and the starry heavens appear in all the splendor of a summer's night, all observation is attracted a this time toward the northwestern horizon where a beautiful comet, visible to the naked eye, shows itself with a truly remarkable lustre.

What is this Comet? It appeared unannounced the 29th of May. Mr Cruls, Director of the Observatory of Rio de Janeiro, observed it for the first a

that date, then the next day and last on the 9th of June. This appearance was immediately signalized to Europe. Now it is visible since the night of the 23d and 24th day of June, above the horizon of our hemisphere. Its principle elements observed to the present, give it a semblance, so to speak, corresponding with the comet which appeared in 1807. The trajectory of the two stars appear to be the same. The comet we are admiring at the present, possesses a very brilliant nucleus, as brilliant as a star of first magnitude.

Its tail is magnificent, notwithstanding it has changed into several new forms lasting lustres. Its progress is rapid; it moves from the sun toward the north, and in a few days will disappear. Whence comes it?

This comet has had a visibility sufficiently prolonged to have permitted numerous and close observations; the elements gathered, astronomical as well as physical, will tell us the probable duration of its revolution.

It is known that of all the comets observed to the present, the number is very limited, of which the periodicity has been determined with precision. Astronomers count eight only. They are

Encki's, period	3 3-10	years.
Bronsen's	5 1-2	"
Winnecke, a little	6 1-2	"
Arrests	5 6-10	"
Biéla	6 6-10	"
Faye	7 1-2	"
Tuttle	14	"
Halley, most memorable of all	66	"

All these differences demonstrate that comets are not, as formerly believed, celestial vagabond bodies, for which the laws of control and calculation did not exist. They observe on the contrary, the same laws of gravitation which govern all the stars of our universe, as they gravitate around the sun, and are dependant on his attraction, with this difference, that in place of following circular curves they follow oval curves, especially eclipses, astonishingly heightened.—*Scientific Correspondence La Presse.*

PECULIARITIES OF THE COMET OF 1881.

BY PROF. ORMOND STONE, CINCINNATI, OHIO.

The great comet now visible has been observed here at every opportunity since its discovery was first made known. On the morning of Friday, June 24th, although the northern sky was quite cloudy near the horizon, the comet was seen long enough to obtain a determination of its position. The head was quite complicated in form, the nucleus itself was very bright and the envelope on the side next the sun was quite similar, in appearance, to that of Donati's comet, as t appeared during the earlier part of October, 1858, as figured by Prof. Bond,

in the Harvard Observatory Annals. This reticulated form of the head did not reappear on any subsequent night. The changes in form have been very rapid and wonderfully interesting. On Saturday morning there were two comparatively bright jets of nebulosity extending out in the direction toward the sun, but, separating and sweeping apart, were apparently driven backward by a repulsive force in the opposite direction. On the same side as these jets three other envelopes whose edges were at about equal distances from one another could be seen, diminishing in brightness as they receded from the nucleus, while another fainter jet was visible, issuing into the darker portion behind the nucleus.

On Monday morning a faint and slender secondary tail was visible to the naked eye extending toward and beyond a point a little to the right of Polaris, the principal tail which was quite bright and broad curving, toward the left and extending to, perhaps, half that distance.

A very interesting phenomenon was observed on Tuesday morning. In the evening only one jet was visible in the telescope making quite an angle with the direction of the tail. During the morning, however, a second fainter jet appeared nearly in the opposite direction from this, and at the same time the principal jet grew broader and finally separated so that now there were three visible, of which the center one was the brightest.

The most remarkable phenomenon, however, occurred last night about ten o'clock. During the early evening the comet was hidden by the clouds, but at about ten o'clock it became visible and at first sight a great change was noticed in its appearance. The fan or jet toward the sun had its usual appearance, but directly opposite this was another jet much brighter and narrower. It appeared nearly as bright indeed as the nucleus itself. A closer examination showed that this was separated from the nucleus by a dark line. After a little this separation became greater and the jet seemed to slowly float away from the nucleus and at the same time to form a fainter nucleus of its own, thus giving the comet for a time, the appearance of being double. The detached portion, however, gradually grew fainter until when last seen, although plainly visible, it was no brighter than the fan-shaped appendage on the opposite side of the nucleus.

CINCINNATI OBSERVATORY, July 17, 1881.

ASTRONOMICAL NOTES FOR AUGUST, 1881.

BY W. W. ALEXANDER, KANSAS CITY, MO.

Mercury, on the 5th, reaches its greatest elongation west of the sun, 19° 6′; the position is favorable for observation, it being in the constellation Gemini, nearly in a straight line with Castor and Pollux, about 9° south of the latter. On the 7th it will enter Cancer and rise at 3h 40m A. M.; by the end of the month it will be in superior conjunction with the sun.

Venus will be as visible as the morning star during the entire month; on the 2d it will enter the northern part of Orion, passing from thence into Gemini on the 6th, where it will remain until the 29th, then enter Cancer. It will be very brilliant and may be seen in daylight; its position being about 3h west of the sun. On the 20th it will be close to the moon.

Mars will be in Taurus all the month. On the 17th it is 4° 42′ north of Aldebaran, the brightest star in the constellation. Its apparent motion is direct, the mean daily increase in right ascension being 2 min. 40.8 sec., and in north declination 7′ 12″. It is slowly approaching the earth and increasing in apparent size. On the 15th it will rise at 11 h. 33 m. P. M.

Jupiter, the giant planet of this system, will rise about 11 o'clock P. M., and attended by its four satellites will present some interesting phenomena to those possessed of a small telescope, or a good opera glass. The satellites of this planet are the most difficult members of the solar system, for the mathematician to calculate, *i. e.* to find how much the attraction of one will affect the position of the others. The effect may be understood from the following laws:

1st. *That the mean motion of the first satellite added to twice the mean motion of the third, is exactly equal to three times the mean motion of the second.*

2nd. *That if to the mean longitude of the first satellite we add twice the mean longitude of the third, and subtract three times the mean longitude of the second, the difference is always 180°.*

The following is a list of their eclipses and prominent phenomena visible at Kansas City during the month: On the 4th at 00 h. 05 m. 04 s. A. M., *Io*, the one nearest to Jupiter, will disappear in eclipse. The same occurs again on the 11th at 1 h. 58 m. 48 s. A. M.

Europa, the next in order of distance from Jupiter, will reappear after an eclipse on the 15th at 00 h. 57 m. 44 s. A. M., and remain visible fifteen minutes and disappear in occultation behind the disk of the planet. On the 22d at 3 h. 33 m. 55 s. A. M., it likewise reappears, remains visible fourteen minutes and disappears. On the 29th at 3 h. 37 m. 51 s. A. M., it disappears in eclipse and does not reappear before daylight.

Ganymede, the third in distance from the planet, on the 14th at 1 h. 44 m. A. M., will appear after occultation and on the 21st at 00 h. 11 m. 29 s. A. M., it will reappear after an eclipse; it also disappears in eclipse on the 28th at 2 h. 37 m. 08 s. A. M.

The orbit of *Callisto*, the fourth satellite, is so much inclined to the ecliptic that it does not get eclipsed or occultated this month.

Saturn, on the 1st will rise at 11 h. 17 m. P. M., and on the 31st at 9 h. 21 m. P. M. On the 24th its position among the stars will remain fixed for a short time, owing to the earth moving in a straight line toward it. The apparent elements of its rings are as follows: Diameter of outer major axis 42.67″, minor axis 14.72″, inclination of the northern semi-minor axis to the circle of declination from north to east 34.3′, the elevation of the earth above the plane of the southern surface of the ring 20° 10.6′, elevation of the sun 18° 29.9′, earth's

longitude from Saturn counted on the plane of ring from the ring's ascending node on the equator, 94° 32.9′, on the ecliptic 51° 48.3′. Apparent diameter of the planet 17.5″.

Uranus on the 15th is within 1 h. 20 m. of the sun. consequently ti cannot be seen to advantage this month.

Neptune is in right ascension 2 h. 58 m. and north declination 15° 5′; being in the constellation Aries it will rise about 11 h. P. M. This is the most remote planet yet discovered in this solar system; it is invisible to the naked eye; seen with a telescope it looks like an eighth magnitude star, unless magnified more than 300 times. Under that power in a good atmosphere it presents a round disk 2.6″ in diameter.

The discovery of this planet is one of the grandest triumphs of mathematical astronomy; comparing observation on Uranus while it was still thought to be the most remote member of the system, astronomers found perturbations or irregularities, that could not be accounted for on the theory of gravitation. Taking the attraction of Saturn and Jupiter into account it was found that no table could be prepared that would agree with the observed position of this planet for any length of time. In 1845 Le Verrier being informed of the matter, went to work to see if the irregularities in the movements of Uranus could not be accounted for by the existence of a planet more distant; he found this to true; and even went so far as to compute its size and to predict in what part of the heavens it would be found at a given date. A letter containing the results of his calculations reached Berlin, September 13, 1846, and that very evening Dr. Galle found the planet within one degree of the calculated place. Mr. Adams, an English astronomer and mathematician had at the same time made independent calculations which were as accurate as those of Le Verrier.

CONSTELLATIONS VISIBLE ON THE 15TH AT 8 H. 40 M.

Commencing on the meridian at the northern horizon, we have Auriga; passing up the meridian towards the zenith we cross Camelopardis, Ursa Minor and Draco; beginning at the southern horizon in the same manner we cross Sagittarius and Hercules.

On the prime vertical east are Pegasus and Cygnus, in the west Virgo and Bootes. In the northeast lie Andromeda, Cassiopea and Cepheus, northwest Leo Minor and Ursa Major; southwest Libra and Serpens; southeast Capricornus Aquila and Lyra.

On July 21st at 3:30 A. M., I observed a small telescopic comet in Auriga Its right ascension was 5 h. 54 m., declination 40° 16′ north. On the 23d, 4 h A. M., its right ascension was 6 h. 02 m., declination 42° north. Its brightness had increased to 1.3, and was visible to the naked eye.

This is probably the great comet which appeared in the year 1337. It will pass its perihelion on August 18th and attain its maximum brilliancy on the 20th At that time it will form a very conspicuous and interesting object, rising in the northeast about three hours before the sun. It will be visible to the naked eye until September 5, 1881.

GEOLOGY.

THE FOSSIL FLORA OF THE CRETACEOUS DAKOTA GROUP OF KANSAS.

BY CHAS. H. STERNBERG.

During March and April of the present year, I was employed by Professor Agassiz in the Dakota Group of Kansas, having charge of an exploring party. I have been very successful, collecting 800 specimens, representing nearly all the species of the Dakota Group and a great many new species.

Professor Lesquereux, the noted palæobotanist, has examined the collection, and described the new species. To Prof. Agassiz he says, "Your (my) collection was very valuable, not only by the number of new species, but also by the beauty and fine preservation of the specimens, from which the specific characters as to the variation of types might be studied with great advantage to science." To me he writes, "I have been delighted to see some very fine, new species; especially four new species of *Liriodendrôn*, (tulip tree,) one from Elkhorn Creek, *L. Cruciformæ*; three from Glasgow, *L. Acuminatum*, *L. Semi-Alatum*, and *L. Pennatipdum*, and there is an entirely well preserved *Liriodendron Giganteum*, which is known from one lobe only figured in the Cretaceous flora."

The *Liriodendon* was known in the Dakota Group by several species, but very few specimens. *L. Cruciformæ* is an anchor-shaped leaf, with an upper pair of lobes cut square at apex, the two basilar lobes are separated from the upper ones by a narrow sinus, and are long, with accute points that are recurved and nearly touch the upper lobes. Another species has all four lobes with acute apeices. Still another have the lobe cut down nearly to midrib, with no intervening sinus or one only a few lines in length. Of the three species of the tulip tree, *L. Meekii*, *L. Intermedium* and *L. Giganteum*, only the last is found in Kansas, and only one lobe was known to science, heretofore. So we have added a genus and a number of species to the Kansas Dakota Flora. We have also discovered fine specimens belonging to the genera *Menospermites*, and magnolia of the order *Polycarpiciæ*. The tulip tree belongs to this order. *Menospermites* is especially well represented by numerous species and well preserved specimens, especially *M. Obtusiloba*, and *M. Cyclophylla.* Of the *Cycadæ*, we have a new species of *Podozamites:* in the order *Filices*, we have *Gleichenia* and *Todea.* *T. Saporteana*, is represented by a number of fine specimens. The order *Zamiæ* has one species of *Pterophyllum.* The *Coniferæ*, have fine specimens of *Sequoia* (Red Wood). *Glyptostrobus*, (Bald Cypress).

All the known genera of the Dakota Group of the order *Cteoideæ*, are represented by fine specimens, *Liquidani Ara* (or Aralia) *integrefolia*, *Populites lirigeosa*,

P. Elegans, and *Salix proteæfolia*. Then we have a new species in the order *Amentaceæ*, *Myrica Sternbergii*. Also *Betula*, and a new species of *Aluites*, a new one of *Quercus*, and *Platanus Primæva*; of the order *Urticæ*, three new species of *Ficus*, represented by fine large specimens.

The order *Laurineæ* is well represented by the genera *Laurophyllum*, *Sassafras*, etc., and the order *Umbelliflora* has magnificent specimens of *Aralia*, *Saporteana*, *A. quinquepartita*, *A. Tonneri*, *A. Tripartita*, (or *imperfecta*) and *A. Concreta*. Also specimens of *Hedra*, and *Cissites*. *C. tenninericæ* is new in science.

The splendid genus *Protophyllum* (catalpa) of the order *Columniferæ*, is represented by leaves of *P. Sternbergii*, *P. Quadratum*, *P. Minus*, etc. The order *Aceraceæ* has a new variety of *Greviopses Haydeni*, and a new species *G. betulæfolia*. The order *Frangulaceæ* has a new species of *Rhamnus*. We have, also, beautiful specimens of *Phragmites*, a leaf with parallel veins. In addition we have a variety of *Tornacia saporteana*, which is, perhaps, new." Then we have a new species, *Anona Cretacea*. A new *Thusites*, two new species of *Sapindies*. We have also large numbers of perfect leaves of *Aspdiophyllum trilobum*, some are a foot in diameter, with thick perfoliated midribs. The *Araliopsis*, is especially well represented by fine leaves of *Sassafras Mirabile* and *S. Mudgii*. I have not yet seen Prof. Lesquereux's list of species collected by my party. But I think we have over fifty species, all of them from eighteen localities that are scattered over the Dakota of Kansas from Ellsworth to Ottawa county. Some localities are 100 miles apart, and each is noted for its own peculiar species. In Ellsworth county the localities are only a few miles apart.

On Spring Creek we find the *Protophyllum*, (Catalpa). The *Sassafras* is very abundant on Thompson Creek. Bluff Creek has beautiful specimens of *Liquidambra integrifolia*. Three miles southwest of Fort Harker are found the splendid leaves of *Aspidiophyllum trilobum*, with some fine *Menospermites obtusiloba* and *Aralia rowueri*. Skunk Creek, south of Fort Harker, furnishes *Aralia quinquepartita*, *A. tripartita*, *A. saporteana*, and *Laurophyllum reticulatum*. The Elkhorn locality contains *Liriodendron*, *Phragmites* and *Salix*. At Churchill P. O., twenty miles above Salina, on the Saline River, *Sassafras Mudgii*. Sixteen miles northwest of Salina, on Saline River, we find *Sassafras Mudgii* and *Menospermites obtusiloba*.

Near Glasgow, we find *Liriodendron*, *Todea*, *Platanus*, *Populites*, *Rhamnus*, etc. Near Minneapolis are found *Aspidiophyllm*, *trilobum* and *Populites Elegans*. Muberry Creek, near Clay Centre, furnishes *Platanus Heeri*. My explorations have confirmed the opinion of Professor Lesquereux, "that the forests of Cretaceous Dakota Group, grew on isolated islands in a wide expanse of waters."

METEOROLOGY.

THE WEATHER MAP AND THE OFFICIAL WEATHER INDICATIONS.

BY ISAAC P. NOYES.

Occasionally we hear the remark—"the Signal Office was way off in their weather predictions yesterday"—"They have not been doing well for the past two or three days." The weather, like many other things is irregular. At times it is almost like clock-work, and may be very well defined for even three or four days in advance; then comes a change. The relations of "High" and "Low" are such that it is more difficult to tell what the weather will be twenty-four hours in advance than at other times to tell what it will be for three or four days in advance. The elements which go to make up our weather system do not operate in regular grooves, but on the contrary are ever on the alert for the best opportunity. Heat and cold vie with each other for the mastership, and "low" is ever seeking the most favorable localities to advance to, and is all the while being thwarted in its course and check mated by "high." In this department of nature as in all other departments, even in affairs of men, as in politics, the great end is after all, more or less influenced by compromise. Nature in this respect, often sets us a wise example. Not that all our actions should be governed by compromise, yet a judicious compromise is often times the part of wisdom.

May 27th to 31st, inclusive, well illustrates the point in question and reveals some of the difficulties that the Weather Bureau labors under. When a statement is made by this office and the same is not fulfilled the weather-map of the succeeding day will reveal the cause and a cause that any fair minded and intelligent person will readily comprehend and make allowance for. The weather map reveals everything and conceals nothing. May 27th the new "low" was in the northwest, "high" in the east, both moving toward the orient. The appearance then was that on account of the situation of "high," "low" would be deflected to the north and that the weather for this locality for the next two or three days would be warm and pleasant but not hot. On the 28th the main lines of "high" had passed off and left the coast apparently clear for "low" to advance without interruption, and the indications were that the advanced lines of "low" would be here on the 29th, passing this locality from the 29th to the 30th. It looked bad for Decoration Day. But "high" after all was not so fast about getting *entirely* out of the way, as it lingered and the rear-guard retarded the advance of "low." For the next twenty-four hours "low" made very little progress and what little advance was made was more to the southward than the eastward; yet we were all the while on the look out for it and expecting it every hour.

On the 30th the situation of "high" and "low" was not relatively changed. Both had worked a little more to the southward. "Low" was still held at bay, but ready to advance toward Washington at short notice.

At 7 A. M. on the morning of the 31st the old "high" had disappeared off the coast. A new "high" was faintly indicated in the northwest. "Low" by this time had been crowded away down into Texas, Indian Territory, Arkansas and Louisiana, liable at any moment from this new position to advance and create what is generally termed a northeast storm. On the afternoon of the 31st this old "low," which had been so long expected finally reached here.

June 1st a supplement to this "low" which had been separated from the main body came marching on. June 2d the coast was comparatively clear again, only a little new "low" in the northwest, which it was not expected would disturb the conditions of this locality; but before midnight its course was such that the indications for the morning of the 3rd of June, were quite different from that of the afternoon of the 2d.

It may be asked if there is no way of ascertaining in advance the course these storm centers will take or the speed at which they will travel across the country. None that we have thus far been able to discover. March 25th and 26th "low" went from the base of the Rocky Mountains to the Atlantic coast in thirty-two hours; on this occasion we see that it took five days for about the same distance.

The indications of the Weather Bureau prove this uncertainty of direction and speed, for they would be most unwise not to do the best they could. The weather map of each succeeding day is a proof of their wisdom and integrity. Let the weather map be well understood, and what are now termed "mistakes" will be revealed to be the best information that human wisdom could devise.

In years to come when the world has comprehended the usefulness of the weather map, and comes to understand the movements of "high" and "low," and becomes weather prophets for themselves, it will be amusing to contrast the writings of to-day, which plead for and defend the wisdom daily revealed on these maps, with the childish comments upon the weather, and the absurd attempts at guessing what the weather will be months and weeks in advance. I have pleaded for intelligence—for the intelligent people of the world to learn something about weather—about it as it stands to-day and as revealed on these wonderful maps; but hardly a day passes but what the most absurd notions in regard to the weather appears in prominent papers, and reveals the fact that many of the most intelligent people in the world are content to trust in sensational prophecies of the weather by those who have not contributed one advanced idea in regard to the changes which go to make up our weather system.

The recent appearance of the comet reveals this fact most forcibly. The peculiar cool weather of June is "all owing to the comet." So they attempt to tell us. Had it been very warm these same parties would have said that it was "all owing to the comet;" as people in different localities on the same evening credit the clear or cloudy sky to the moon. It would seem that intelligent people

should rise above such incongruities. Wisdom it would seem should inspire confidence, but instead ignorance seems to carry the day, at least in this department of the weather. If one will consult the weather map for the month of June they will see that "Low" most of the time passed over the country on a medium low line of latitude. The course of the majority of these "lows" or storm centres being from the northwest passing east on a line gradually working to the southward, even going as far south as Cape Hatteras and then along the coast to the northeast section of the country. Occasionally, however, one or two would keep on a high line. When they did so it was warm.

These "lows" were so peculiar, so variable that it was most difficult to predict the result. The sudden changes necessitated variable "indications." For example it often happened that the evening paper would prepare the public for the next day to expect a certain kind of weather, when the change in only twelve hours would be such as to cause an "Indication" for the day to be quite the reverse. Then as on the 27th, 28th and 29th of June the confines of the area of "low" hovered about the locality of Washington. The storm centre had really passed and "indications" were published in accortance therewith. But these is no knowing what to expect from what may be termed the "posterior low,"* especially when "low" is on a high line, when the tendency is to create intensity of heat, or as it were develope local sub-"lows." Where these "lows" will develope it is beyond the power of man to know. We know that they will develope somewhere within an area of three to five hundred miles—such things in nature being on a large scale—but where will the objective point or point of concentration be, that is a question that I am thinking will ever defy the perception of man to find out in advance of the local demonstrations as revealed to the locality by that peculiar effect of "closeness" in the atmosphere which precedes the storm.

As before stated in these papers, nothing better illustrates the course of "low" than to pour some water upon a slightly inclined plane and note the effect. Of course we know beforehand that it will take a certain general direction. But just note the course it takes how it circumvents spots, taking a zigzag course and coming together again, leaving certain spots dry, others wet, and never twice a alike. So with these "lows" and especially these "posterior lows" travel. To undertake to say just where local thunder storms or tornadoes will take place is most absurd. We know that they must take place somewhere within the general limits of "low" or the track of "low." But who will map out the lines beforehand? As well may we attempt during a thunder storm to tell the exact places where the lightning will strike. We know that lightning is very apt to strike somewhere during a thunderstorm, but to pretend to be able to locate the spot or to request another to so is most absurd. Always when a storm centre is passing or has passed, we are liable, according to the season of the year to have cer-

* In the future in these papers I will use the following terms to indicate the different phases of the storm centre. The "anterior low" to indicate that which precedes the centre propel; the "posterior low" to indicate that portion following the centre.

tain effects which we term thunder storms, tornadoes, etc., but to locate them exactly or to say that they will positively occur seems most absurd to prophesy. Yet with all this intelligence and undeniable facts people even suggest and seem to believe that the sensational weather prophets must have some knowledge, some secrets of the weather patent to themselves which have not as yet been discovered even by the Weather Bureau, and many seem to have the idea that the Weather Bureau is well enough in its way for daily indications, but that the "weather prophet" system is better for forecasting the weather weeks and months in advance. They would, as it were, make a compromise between the two. Such remarks only prove ignorance of the subject on the part of those who make them.

In this connection it must be borne in mind that the daily "indications" is only a part of the work of the Weather Bureau. The main work, whether realized or not, is to gain a knowledge of the meteorology of the world, and only through such efforts have we gained our present knowledge, in comparison with which all the knowledge of the "great weather prophets" of the world is as nothing and mere boy's play. Instead of the "prophet" system being superior to that of the Weather Bureau, it is in self impractical, unscientific and worthless, for the reason that there is no dependence in the idea that the weather periodically repeats itself. The changes are endless, and there are so many powers and counter-powers at work, for them all to work together to produce results twice alike is absurd and unwarranted the by facts by the best authority accumulated in this department of science.

The friends of one of the "weather prophets" claim that he can tell what the weather will be for a year in advance, even to the month and day. Let any intelligent person consult the almanac of this "prophet" for 1881 and note the prophecies for the first half of the year and compare them with what has actually taken place. For the month of June nothing could be more reversed. Seeing, however, that the month of May was prematurely warm he issues another statement quite the reverse of his first—evidently founding it upon the idea that premature heat at this time of the year will be followed by cool rather than warm weather. All of these attempts, however, were of no practical value or any nearer the mark than any person could do who knows about what kind of weather is most likely to occur during the different months of the year. According to this man we were to have a fearful storm throughout the west and east on the 20th of June, but the map for the day previous was clear as to the west, with only a probability of a local thunder storm or two in the east. But then it does not seem to matter how far from the mark this man comes; "great things" are claimed for him. Claims, it would seem, that the intelligent people of the world would have little respect for. The only reason that there is respect for such prophecies lies in the simple fact of want of knowledge of the weather system. Let this subject be understood as well as the other sciences of the world and we will have an entirely different order of things in this department. We will have

a more complete weather system. As for "weather prophets" they will all be at a discount.

The future will demand more stations, especially throughout the west. The result of this will be better daily reports, whereby better and more advanced weather indications may be given to the country. The more we advance in this direction the more satisfaction will we derive from the system as a whole. Let the intelligent world once see and fully realize this and they will do all in their power to advance the interests of a worthy Bureau which at present seems to receive little favor from them.

Attention paid to error is detrimental to truth and honesty, while attention and support to that which is true advances truth and honesty and helps to build up the whole moral character of the world. Advances the human race and establishes a broad foundation for it whereby it may the more successfully contend against that which is false.

WASHINGTON, D. C., July 4, 1881.

METEOROLOGICAL REPORT FROM JUNE 20, TO JULY 20, FROM OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA, KAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

TEMPERATURE OF THE AIR.	June 20th to 30th.	July 1st to 10th.	July 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	61.4	69.9	72.6	68.
Max	84.5	89.4	94.1	89.3
Min. and Max	72.9	79.6	83 3	78.6
Range	23.1	19.8	21.5	21.5
TRI-DAILY OBSERVATIONS.				
7 a. m.	70.1	78.4	82.	76.8
2 p. m.	79.7	86.6	89.8	82.
9 p. m.	75.0	79.9	83.6	79.5
Mean	75.9	81.3	84.4	80.5
RELATIVE HUMIDITY.				
7. a m.	.87	.73	.74	.78
2 p. m.	.73	.65	.64	.67
9 p. m.	.81	.72	.69	.74
Mean	.81	.69	.69	.73
PRESSURE AS OBSERVED.				
7 a. m.	28.90	29.11	29.12	29.01
2 p. m.	28.93	29.05	28.96	28.98
9 p. m.	28.93	29.05	28.96	28.98
Mean	28.92	29.07	28.98	28.99
MILES PER HOUR OF WIND.				
7 a. m.	10.3	11.2	6.7	9.4
2 p. m.	13.1	16.2	10.3	13.2
9 p. m.	9.6	11.7	10.6	10.6
Total miles	2908	3003	2543	8454
CLOUDING BY TENTHS.				
7 a. m.	6.3	2.2	4.8	4.4
2 p. m.	3.9	3.7	6.4	4.7
9 p. m.	3.9	.1	2.1	2.0
RAIN.				
Inches	2.60	.00	.44	3.04

The weather of the first twenty days of June, which was very favorable to the growing of crops, continued through that month. Since then there has been very little precipitation and the temperature has been very high.

Extremes both of high and low barometer have occurred, but no severe storm been developed in this locality.

Highest temperature 98°, on the 18th. Lowest temperature 48°, on the 28th.

Highest barometer 29.36, on the 2d. Lowest barometer 28.70, on the 20th.

Miles traveled by the wind 8455.

Highest velocity of wind 48 miles per hour on the 21st.

The usual summary by decades is given above.

BOOK NOTICES.

BUTTERFLIES, THEIR STRUCTURE, CHANGES AND LIFE HISTORIES. By Samuel H. Scudder, octavo, pp. 322; New York; Henry Holt & Co., 1881. Price $3.00. For sale by M. H. Dickinson.

In this field of investigation there is no more skilled and enthusiastic explorer than Mr. Scudder. He has devoted years to this branch of science, and his works on entomology, fossil and present, are numerous and exhaustive, including "Fossil Myriapods of Nova Scotia," "Catalogue of Orthoptera," "Fossil Butterflies," etc.

The work under consideration treats of the egg, the caterpillar, the chrysalis, the butterfly, the internal organs of caterpillars, the transformations of the internal organs during growth, the habits of the butterfly, their seasonal changes, coloring, diversity of the sexes, origin and development of ornamentation, ancestry and classification, geographical distribution, instructions for collecting, rearing, preserving and studying, closing with a list of butterflies with scientific and popular names and list of their food plants. This covers the whole ground and gives the reader or the student a comprehensive view of the whole subject, written in an easy and attractive style and illustrated in the most artistic manner.

To say that it is the most complete and thorough treatise that has yet been published on this subject, is to come far within the truth, and to say that it is the most beautifully printed, illustrated and bound scientific work of the day, is to no more than do justice to the publishers, who are giving great attention to this class of books, so much needed at the present time.

FAMILIAR TALKS ON ENGLISH LITERATURE. By Abby Sage Richardson; 8vo pp. 454; Chicago; Jansen, McClurg & Co., 1881. Price, $2.00.

This history of English literature is very naturally divided into six parts, viz 1. English Literature Prior to Chaucer, 449 to 1300. 2. From Chaucer to Spen

ser, 1400 to 1600. 3. From Spenser and Shakespeare to Milton, 1550 to 1608. 4. The Civil War and Restoration, Milton to Dryden, 1608 to 1700. 5. From Pope to Wadsworth, the 18th Century. 6. The Lake School and Its Contemporaries, 1790 to 1822. Each part is fully illustrated with copious selections from the best writers of that period, while a historical sketch of the times and of writers themselves keeps up the continuity and interest of the work and lends additional attractions to it. Mrs. Richardson is an experienced lecturer on topics of this kind and is as thoroughly familiar with the subject as any author of the present day. She is also a ready and pleasing writer, who is sure of readers at all times and in all portions of the country.

Her judgment in the selection of appropriate and characteristic passages from the various authors referred to is excellent, and the logic of her arrangement in demonstrating the progressive growth of the English language in power and mobility is unassailable. As a book to be placed in the hands of teachers and younger readers as a guide in tracing the history of our literature, we know of no superior.

The typography and other points in the bookmaker's art are excellent, and do credit even to such publishers as Jansen, McClurge & Co.

ZUNI AND THE ZUNIANS. By Tilly C. Stevenson, pp. 30, large octavo; 1881.

We are indebted to Professor O. T. Mason for a copy of this interesting and valuable monograph. The writer was a member of the expedition sent out by Major J. W. Powell in 1879, to visit the pueblos of New Mexico and Arizona, and consequently had unusually good opportunities for investigation and exploration. The greater portion of the work is devoted to a careful description of the Zuni pueblo, which is situated in western New Mexico, and is the remains of a large village and populous race which have been reduced by war and disease to the present size and number. The author concludes with the expression of earnest hope, which is fervently concurred in by all of as who have visited this most attractive field for the archæologist, that the "government will with enlightened liberality cause further research to be conducted in the interests of archæological and ethnographical service, and secure for itself, before it is too late, the data required to fully elucidate the history of the Pueblo Indians." The illustrations, which are numerous, are mostly borrowed from the Smithsonian Institution, and, consequently of the first quality.

REPORTS ON THE TOTAL SOLAR ECLIPSES of July 29, 1878, and January 11, 1880, issued by the United States Naval Observatory, 4 to pp. 426, Washington, D. C., 1880.

This magnificent work, the most perfect specimen of government bookmaking we have ever seen, comprises the instructions issued to observers. Observa-

tions at Creston and Separation, Wyoming; Idaho Springs, Central City, Pike's Peak, Denver, Schuyler, La Junta, West Las Animas, Colorado; Dallas, Texas, and other places of less importance. Among western observers, we notice the names of such astronomers and engineers as Prof. Ormond Stone, of Cincinnati, Ohio, Capt. E. L. Berthoud, of Golden, Colorado, Profs. C. W. and H. S. Pritchett, Glasgow, Missouri, Prof. J. C. Watson, of Ann Arbor, Michigan, Prof. Jos. Ficklin, of the Missouri University, and D. H. Talbot, of Sioux City, Iowa. All of the more prominent astronomers of the east, including those in the service of the Government, make very full reports.

To this report is added one on the Total Solar Eclipse of January 11, 1880, at Santa Lucia, California, by Prof. Edgar Frisbie, U. S. N.

The illustrations in this volume are executed most artistically. The photographs could not be reproduced correctly, but the wood cuts and lithographs (by Mr. Julius Bien, of New York,) are superb.

THE GOSPEL HISTORY. By James R. Gilmore and Rev. Lyman Abbott, D. D., 16 mo. pp. 830. Fords, Howard & Hulbert, N. Y., 1881. For sale by M. H. Dickinson. Price, $1.75.

This is a complete chronological narrative, woven from the text of the four evangelists, with notes, original and selected, and indexes. The names of the two authors are a sufficient guarantee of exactness, scholarship and elegance of style, and it will be found fully equal to the expectations of the most sanguine student in all of these points. The amount of work done by the authors or, perhaps rather, editors, as shown by the lists of authorities consulted, must have been immense, while the copious notes and references, chronological indexes, etc., show how careful and thoroughly every part of the labor has been performed.

It is just such a work as every Sunday School teacher and advanced scholar needs for reference, while for family use it has no equal.

The mechanical part has been well done, and the publishers are entitled to full credit for it.

SHADOWS OF SHASTA. By Joaquin Miller; 12 mo. pp. 184. Jansen, McClurg & Co., Chicago, 1881. Price, $1.00

It is difficult to properly criticise a book which is neither history nor romance, although evidently written with both objects in view. Mr. Miller's style is of the intense order at all times, but in our judgment better adapted to poetry than passionate and vindictive prose. In the former we can overlook exaggerated and dramatic description, but in the latter we rely upon sober and stern facts to produce lasting impressions. In this book the author's vigorous assertions savor too much of the imagination to carry much weight with them, especally when framed as they are in poetical figures and improbable romance.

There is no doubt that the Indians have been sadly mistreated by dishonest contractors and avaricious agents, who were false to their trusts, but here in the West the Indian character has lost the halo of glory which surrounded it in the past and in the far off East, and the people are not likely to be aroused to any extreme sense of the great injustice and cruelty that have been practiced upon them by a book of this character. No one on the western borders of the United States believes that the "Government makes its army an instrument for oppressing and pillaging the weak, and the tool of thieves," as the New York *Tribune* says, in commenting favorably on this book.

We have a due regard for Mr. Miller as a poet, but we honestly believe that in this case he has given too loose a rein to his fancy for his credit, even as a reliable romancer.

Doubtless the work will meet with a large sale and will have a good effect in moulding a public sentiment which will compel the appointment of a better class of agents and a more rigid surveillance of them by the Government. For this purpose it may be that exaggeration and injustice can be condoned.

OTHER PUBLICATIONS RECEIVED.

The Alienist and Neurologist, quarterly, 160 pages, C. H. Hughes, M. D., St. Louis, $5.00 per annum; The Harvard University Bulletin, No. 19, by Justin Windsor, Librairian, June 1, 1881; Studies in Astronomy, a lecture elaborated for general readers, by Arthur K. Bartlett, Battle Creek, Michigan; On the Determination of the Error and Rate of a Clock, by the Method of the least Squares, by Prof. Ormond Stone, Cincinnati, Ohio; Report to the Governor and 39th catalogue of the Missouri University, 1880–81; On an occurence of Gold in Maine, and a Microscopical study of the Iron Ore, or Peridotite of Iron Mine Hill, Cumberland, R. I., by M. E. Wadsworth, May, 1881; The Tourist, by Rand, McNally & Co., Chicago, 1881; American College Directory, vol. 3, 1881, C. H. Evans & Co., St. Louis, Mo.; Twelfth Annual and Thirteenth Statistical Report of the Cincinnati Board of Trade and Transportation for the commercial year 1880, and the fiscal year ending March 1, 1881, by J. F. Blackburn, Secy.

SCIENTIFIC MISCELLANY.

NOTES AND QUERIES.

The following is the text of the act of the Legislature of Arkansas officially determining that the correct pronunciation of the name of the State is "Arkansaw:"

Be it therefore resolved, by both Houses of the General Assembly, That the only true pronunciation of the name of the State, in the opinion of this body, is that received by the French word, presenting the sound, and that it should be pronounced in three syllables, with the final "s" silent. The "a" in each syllable with the Italian sound, and the accent on the first and last syllables being the pronunciation formerly universally and now still most commonly used; and that the pronunciation with the accent on the second syllable with the sound of "a" in man and the sounding terminal of "s" is an innovation to be discouraged.

T. J. CHURCHILL,
Governor of Arkansas.

Approved March 15, 1881.

Hon. W. G. Ritch, in his inaugural address before the Historical Society of New Mexico, mentioned that the first merchandise received in the territory from east of the plains came from Kaskaskia, Illinois, in 1804. This is probably true, but Mr. Ritch does not mention the fact connected with this beginning of the overland trade. In the year mentioned William Morrison, a gentleman residing at Kaskaskia, who was largely engaged in the trade with the Indians on the Upper Missouri, fitted out a Canadian voyager named Baptiste Lalande, with a stock of goods and sent him to the Pawnees on a trading expedition. Lalande, after arriving among the Pawnees, found there some Spaniards from Santa Fe, and, learning from them that he could dispose of his stock there to a good advantage, pushed on to that place. Upon arriving there he sold the goods entrusted to him and, being pleased with the country concluded to remain there, at the same time appropriating Mr. Morrison's money to his own uses. In 1806 Lieut. Pike explored the sources of the Arkansas, and, encroaching on Spanish territory, was taken into Santa Fe. In his command was one Dr. John H. Robinson, to whom Mr. Morrison had entrusted his claims against Lalande, but by this time the latter had squandered the money and was unable to make restitution. The fact was developed, however, that there was money to be made in sending goods to Santa Fe, and the overland trade began.

J.

Does science to-day sustain the conclusion of Gauss of Göttingen, that the centers of terrestrial magnetism are not the so-called "poles?"

Are these poles the places of greatest magnetic intensity?

If so, would not the presence of such physical force be unfavorable to any or all of the now known forms of life?

This being true, would not such conditions preclude the possibility of ever effecting the discovery of and direct approach to the so-called poles?

What is the scientific opinion of the theory that the discovery of another continent, as great in extent and resources as any now known, will attend the discovery of the "Northwest Passage?"

ANON.

I have a copper gilt medal, two inches in diameter, dated 1512, with a lion and bear rampant over two shields, sword in hand, blazing sun above them, and the inscription "*Hoc duce pugnamus*," on the obverse side. On the reverse is the date, as above, a quantity of flags, arms, drums, etc., with the inscription "*Un— Crescunt splendore leones et ursi.*"

Can any one explain it, and inform me what occasion it is intended to commemorate? C.

I have just finished reading J. P. Jones' article on the location of Fort Orleans. This interesting article has excited a great deal of interest in me and I think I can contribute something to this question.

I have a large map of the United States and Canada of date 1793–1880. A French reprint of Arrowsmith's Map by F. Tardieu, Paris.

He places the position of *Fort Orleans*, on the *north* side of the Missouri River, between Grand and Vaseuse River, just between the confluence of two small nameless creeks. *The village of the Missouris is plainly shown on the south side of the river.* No account I have ever read, or any map I have ever seen gives the Missouris any villages on the *north* side of the Missouri River. The map indicates no island upon it.

Hennepin's map, Leyden Edition, 1704, places Missouri villages on south side of Missouri River very near its entrance into the Mississippi.

I see that Major Long in his ascent of the Missouri River in 1820, does not mention Old Fort Orleans, but gives a good description of Fort Osage.

Fort Osage was located where now stands the town of Sibley.

According to my map Lewis and Clark are in error, as they make the site of Old Fort Orleans five miles below Grand River. In this map it is fifteen or twenty miles above.

Des Payes in his travels in Louisiana, 1768–69, does not mention Fort Orleans.

I have sent for some more old accounts of Louisiana and for some old maps of New France. When received I will look up this point more critically.

E. L. B.

REVIEW, Vol. 5, No. 1, "Antiquary—Reply. The Confederate Congress ordered a seal engraved in England with the following motto: "*Deo Vindice*," and with a device representing an equestrian statute of Washington. This seal did not reach Richmond until just about the time of the surrender of Lee and no official impression was ever made with it.

Whether the generals served without commissions or not, I cannot say, but General Robert E. Lee testified before the Committee on the conduct of the war, that he could not remember that he had ever taken an oath of allegiance to the Southern Confederacy. J.

Gallatin in his synopsis of the Indian tribes, published in the second volume of transactions of the American Antiquarian Society, in speaking of the southern branch of the Sioux Indians, says: "The five other tribes of the sub-division are the Ioways or *Pahoja*, the Missouri's or *Neojehe*," etc. Can any of the readers of the REVIEW inform me where the term *Neojehe* is obtained and what it means. J.

REVIEW, Vol. 5, No. 1, G. C. Broadhead—Reply. I know of but two treaties made by the Government with the Osage Indians for the cession of lands. The first, that of 1808, to which you refer, they ceded, 33,173,383 acres in Missouri, and 14,830,432 acres in Arkansas. This cession comprised all their lands in Missouri. The second treaty was in 1818. J.

EDITORIAL NOTES.

THE twenty-ninth annual meeting of the American Pharmaceutical Association will be held in this city, this month, commencing on the 23d and adjourning on the 27th inst. This is the first time the Association has held a meeting as far west as this point, and from present indications the meeting promises to be unusually attractive, as the western druggists are taking an active interest. The display of Chemicals will be grand, as the large hall (Board of Trade) which has been secured has been divided up into spaces to suit the demands of exhibitors, and every foot has been taken by prominent manufacturers, among them many who will make their display at our meetings. The railroads and the hotels will make liberal reductions for persons wishing to attend. The local committee, of which Wm. T. Ford is secretary, is arranging for excursions, etc., and will spare no pains to render the occasion pleasant and profitable.

WE call attention to the Institutions of learning advertised in our columns this month. They are, of their kind, the best schools in the west and we advise students to confer with the authorities before deciding to go further and perhaps fare worse.

PROF. CHAS. STERNBERG writes us from Ft. Riley, Kansas, that while on his recent exploring tour he discovered in Gove county the upper and lower jaws and premaxilla of a *Leiodon proriger* Cope. The lower mandible was three feet and nine inches long and perfectly preserved. Up to the time of writing (July 7th) he had collected 119 fossil fishes, 22 saurians and 2 pterodactyls.

WE are gratified to learn that Prof. H. S. Pritchett has been elected Professor of Astronomy in Washington University at St. Louis, in place of Prof. Rees, who goes to Columbia College, New York. Both are able men, and we congratulate the respective institutions in having secured them.

CINCINNATI has followed the example of Kansas City and St. Louis by adopting the electric time ball, which went into operation on the 18th *ultimo*.

PROF. C. S. SHEFFIELD, so well known here, has been re-elected President of the Pierce City Baptist College, and placed in charge of the financial as well as its educational management.

Prof. Ormond Stone, of Cincinnati, who has been studying the newly discovered comet, says it is his opinion that it is the comet of 1337, that it may become visible to the naked eye, and will reach perihelion about August 9th.

Nearly all the railroads leading towards Cincinnati have reduced their rates to members of the American Association for the Advancement of Science which meets there on the 17th inst. Those attending will doubtless enjoy the occasion very highly, as the people of Cincinnati are noted for their scientific culture and their hospitality.

Mr. W. W. Alexander informs us that at 8:25 on the night of July 25th, a large and brilliant meteor appeared and passed across the sky from the southeast to the northwest. As near as he could estimate it was three times as bright as the planet Venus. It had a luminous train, or tail, about 2° in length. Its apparent motion was very rapid, traveling over 120° in ten seconds.

The article on Arctic Exploration in this number was written by a thoroughly competent person and will be a valuable one to preserve, since it gives a full account of all the expeditions now out under the auspices of the United States, and by referring to it at any time when news from any of them suggest it, the reader can comprehend the situation without trouble.

We are promised an occasional article from he pen of Dr. A. B. Stout, of San Francisco, author of the article on The Aleutians in he present number of the Review. As the Doctor has given a great deal of attention to such matters, and the Pacific coast is a prolific field for the ethnologist and archæologist, we feel much gratified to be able to make his announcement.

ITEMS FROM THE PERIODICALS.

The contents of the *Popular Science Monthly*, for August, are as follows: The Herring, by Prof. T. H. Huxley, F. R. S.; Physical Education, by Felix L. Oswald, M. D., Recreation; The Blood and Its Circulation, by Herman L. Fairchild, (Illustrated); The Teachings of Modern Spectroscopy, by Dr. Arthur Schuster, F. R. S. (Illustrated); Origin and History of Life Insurance, by Theodore Wehle; The Insufficient Use of Milk, by Dyce Duckworth, M. D.; Intelligence of Ants, by George J. Romanes; Lunar Lore and Portraiture, by F. E. Fryatt; The Visions of Sane Persons, by Francis Galton, F. R. S.; Schoolroom-Ventilation, by Dr. P. J. Higgins; Origin and Uses of Asphalt, by Leon Malo, C. E. (Illustrated); The Unit in Plant-Life, by Byron D. Halstead, Sc D.; The Electric Storage of Energy; Sketch of Robert Wilhelm Bunsen, (with Portrait); Correspondence; Editor's Table; Literary Notices; Popular Miscellany, and Notes.

The Princeton *Review*, for July, contains the following articles: Continental and Island Life, by John W. Dawson; English Poetry in the Eighteenth Century, by John C. Sharp; The Historical proofs of Christianity, by George P. Fisher; Philosophical Results of a Denial of Miracles, by John Bascom; Late American Statesmen, by Francis Wharton; Anthropomorphism, by M. Stuart Phelps. The Princeton *Review*, under the new management furnishes its readers with papers from the best thinkers and writers on both side of the Atlantic. The present number is fully up to the standard. One generally reads such publications by an eclecticism, dipping in here and there to taste the quality, but the present number will be read through from beginning to end with unabated interest.

Rev. H. C. Brown commences with this month the publication of a new family monthly called the *American Home Magazine*. An examination shows that it is well arranged, well edited and well printed. Mr. Brown's reputation as a scholar and a minister is a sufficient guaranty that it will be kept upon a high literary and moral plane, and we predict for it abundant success.

Lieutenant Schwatka continues in *Good Company*, for June, his interesting articles entitled "In the Land of the Midnight Sun," and to the same number Mrs. General Wallace contributes one on "The Land of the Pueblos," while S. J. Douglas gives us "An Ornithologist in Arctic Russia."

The *Atlantic*, for September, will give the second installment of Mr. Howell's delightful novel, Dr. Breen's Practice, which promises to be the author's most successful work. Among the miscellaneous papers will be an interesting essay on The Housekeeping of the Future, a charming sketch of A Florentine Family in the Fifteenth Century, an article on The Future of Harvard Divinity School, and a study of Fairy-lore by Mr. John Fiske. The number will also contain the concluding part of Mrs. Foote's story, In Exile, and the continuation of Mr. James' Portrait of a Lady, with the usual Literary Reviews, Contributor's Club, and Books of the Month.

The *Humboldt Library* closes its first volume (755 quarto pages) with Popular Scientific Lectures by Prof. H. Helmholtz, and its publishers will furnish the whole set, bound, for $4.00.

Prof. Henry A. Ward, of the Natural Science Establishment, Rochester, N. Y., has commenced the publication of *Ward's Natural Science Bulletin*. It will be issued irregularly this year for gratuitous circulation; next year it will be published regularly at a stated price.

One of the most important contributions to the August *Harper's Monthly* is Mr. Frederick G. Mather's paper, "Water-Routes from the Great Northwest." This paper is especially timely in connection with the opening of the New Welland Canal; and all questions of interest as to the future ascendancy of the Erie Canal or the St. Lawrence system, as well as the bearings of Mississippi transportation and railway competition, are very thoroughly discussed. The article is amply illustrated with maps and plans. Western merchants and shippers will find it to their interest to study it.

The *North American Review*, for August, presents an admirable table of contents, but the most notable article is the discussion of Christian belief by Col. Robert Ingersoll and Judge Jeremiah Black, which will attract a wider attention than any article presented in any magazine in the country this month The difference between the two is like tha between an active, buzzing, and stinging pois onous insect, which, though brushed awa over and over, returns to the charge more an noyingly than ever, and a strong man, wh finally crushes it into an indistinguishabl mass.

KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. V. SEPTEMBER, 1881. NO. 5.

GEOGRAPHY.

HEATH'S DISCOVERIES IN SOUTH AMERICA. II.

BY PROF. JOHN D. PARKER, KANSAS CITY, MO.

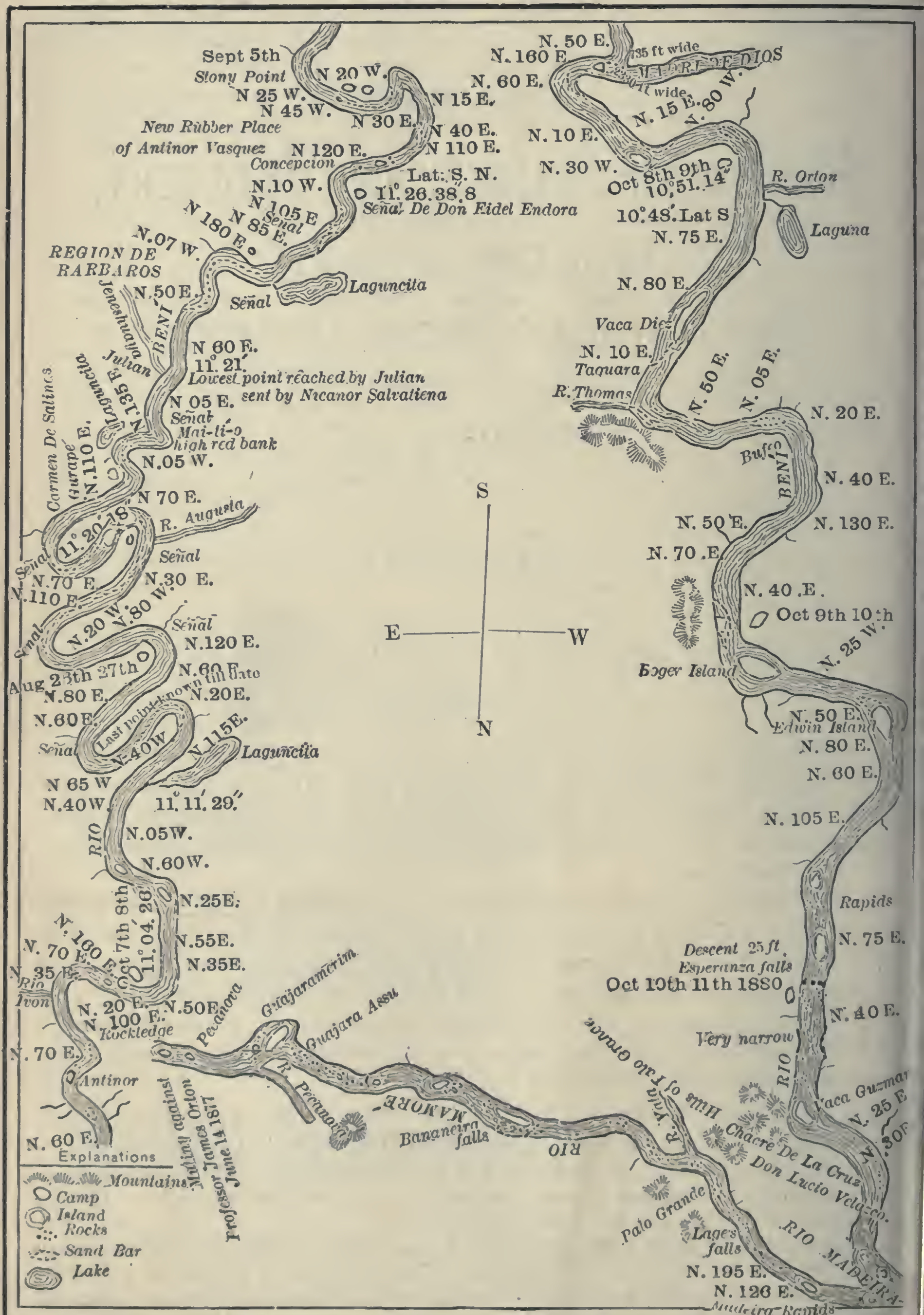
In the April number of the REVIEW, it was my privilege to announce the recent important discoveries of Dr. Heath in South America. In the present paper, further information is given regarding those discoveries, in the form of correspondence, which is accompanied with a map of the recently explored section of the Beni River.

Dr. Heath has also sent carefully executed drawings in ink of the hieroglyphics on the rocks of the various falls of the Madeira River. They were evidently left inscribed on the rocks by a pre-historic people, and are highly interesting as studies for the antiquary. Like the hieroglyphics of Egypt they may finally be deciphered and give us some clue to the history of the ancient people who left them as vestiges of their existence. It is hoped that fac-similes of these hieroglyphics may soon be given to the public.

The following account has been compiled from the correspondence of the explorer by his brother Dr. Ivon D. Heath, of Wyandotte, Kansas :

The Doctor's letter is dated, Los Reyes, Departamento del Beni, Bolivia, April 1st, 1881. A month previous he had sent a letter, full of details of his explorations, which has not been received.

The letter of April 1st, with which was a very accurate and skillfully executed pen and ink map, twelve feet long, of the Beni River, a table of meteorological observations and an atlas of drawings of hieroglyphics from the rocks of the falls of the Madeira was sent all the way to the American Minister at La Paz



THE RECENTLY EXPLORED SECTION OF THE BENI RIVER.

by special messenger in order to insure its safe arrival. In the letter the Doctor gives much of real interest. In his descent of the known portion of the river Beni, he spent several days at Cavinas, a Catholic missionary station. This settlement is frequently visited by wandering bands of various Indian tribes, and at the time of the Doctor's visit, he met there a score of Araiina Indians who live on the Madre de Dios, nineteen days journey northwest through the forest. These Indians were entirely nude. Inquiring of them concerning the descent of the Beni, they were horrified and answered, "How is it that you think of descending the great river when we, who are men, cannot?" "How is it," asked Dr. Vaca, "that you are men and we are not?" "Because we see that you have but one wife, while the most worthless among us can support at least three."

These Indians were cannibals, and the Padre at Cavinas related to the Doctor, that on one of their visits to the mission either by indolence or lack of fortune in hunting, they were without meat and were hungry. One of the men who were lying on the ground arose, seized a nursing child by the feet, and tearing it from its mother's arms and breast, with one whirl in the air brained it against the ground, and with the same motion tossed the little thing upon the glowing embers—when cooked, mother and all sat by and feasted.

Dr. Heath writes that Dr. Vaca, proprietor of several rubber camps, had nine of these Indians, who consented to work for him two months. Three years previous Dr. Vaca bought a boy of this tribe for an ax. The boy now understands Spanish, and serves as interpreter. "Accepting Dr. Vaca's offer, I prepared to go with him whilst he and Don Antenor Vasques proceeded 'to visit.' This they do by sitting face to face with a bottle of liquor and frequently drinking each other's health. At 3 P. M. I was ready—Dr. Vaca was not—we waited till 11 o'clock, when he awoke and we embarked. He had an iron bedstead set upon the seats of the boat and having left my mattress and carrying only a blanket, my bed on the iron slats was not the most comfortable. Dr. Vaca and a sick friend occupied the camarote (shelter of ox hide). He had a bass drum, two snare drums and two flutes, playing all the time, while beneath my bed were huddled together the nine cannibals. At 2 A. M. we stopped to see a sick rubber collector, and at 3 A. M. resumed our course down stream. This was a night never to be forgotten. I have been in many strange places, but this rather exceeded all before."

For the exploration of the unknown portion of the river, Dr. Vaca furnished the boat and one man, and Don Antenor Vasquez the other man. His boat was fifteen feet long and four feet wide, and, when loaded for the long voyage of exploration, was but three fingers width out of water.

"Arriving at the confluence of the Beni and Mamore, the ascent of the latter was very hard with but two Indians to paddle. The Mamore River is much larger than the Missouri, and resembles the latter river in its yellow water, its sand bars and in its drift wood. At the rapids of Palo Grande we unloaded the light things and carried them to the upper landing After several trips we started with the boat in which were a few heavy articles, and after hard work with long rope, we reached the whirlpool at the fall. Stepping into the water and tying a rope behind, we carefully approached the foot of the fall. The sight and roar of the rushing waters half crazed one of my men, and, having the leading rope, he pulled with all his power. I was standing deep in the water working to keep the boat near the rocky shore, and protect it from being destroyed. The strength of the excited Indian who was unaccustomed to the rapids and falls of the Mamore and Madeira, was too much for us, and the boat shooting forward with great velocity, I gave up all hope, expecting to see it dashed in pieces against the rock on which he was standing. The current carried the boat faster than the

Indian could take in the slack, and, sheering off, the boat struck the fall instead of the rocks and instantly filled, floating away our five arrobas of harina (yuca flour, or tapioca,) our paddles, plantains, yucas, rice. We also lost our last machete, and my rubber clothing. After much risk and labor the boat was tied up and bailed out. When sure of my boat, I seated myself upon a rock to rest and study our situation."

"Here we were, three men more than 300 miles from any settlement, surrounded by a dense forest, without paddles, and destitute of any wood-cutting instrument, our mainstay of food with the paddles in the center of a powerful whirlpool. Although the Mamore has been the only highway of travel and commerce for more than 300 years yet it may be days or even weeks before any boat passes. What can we do was my study as I sat in the hot sun. Shall I try to save paddles and harina? Have I physical strength sufficient to overcome the whirlpool? That I could enter and return was doubtful even without a burden. Our harina was sewed up in a rawhide and floated. Round and round went paddles and packages dancing in the waters. Fastening a rope to the shore, with the other end in hand, I quietly slipped into the water, and while being carried around swam for the center of the whirlpool. Just now my two men discovered me, and their cry of horror reached my ears above the roar of the waters. Arriving at the center I fastened the rope to the package of harina, and, hand over hand on the rope, worked my way out. The revolving of the package in the water gradually shortened the rope drawing its burden out of the center of the whirlpool. After a long rest I returned for our paddles, securing two of them—the other was irrecoverably lost. However, I found on shore a blocked-out paddle which by successive charring over fire, and scraping with a sharp stone, I finally succeeded in reducing to a serviceable shape."

"Boats generally keep near the Brazilian shore The morning after the passage of the falls of Guajaramerim we heard a human shout from the Bolivian shore. With the field glass, I discovered a Chocoba Indian who signaled us to cross over. Finding that we would not comply, the sand bar on that side was soon covered by naked savages with bows and arrows."

Arriving at Exaltacion the news of the successful exploration spread like wild-fire. New rubber forests are to those people what new gold-fields are to those of North America. The Sub-Prefect of the province sent a barge with nine powerful Mobima Indians to escort the Doctor to Santa Ana.

On his near approach to Reyes everybody turned out to receive him with ringing of bells, firing of guns and music; even the school children marched three miles from town to greet him with songs and floral offerings.

The Doctor writes that everybody talks Beni, and either goes to the new rubber forests or sends some one—that 10,000 men have already gone down the river; that last year the export of rubber from the Beni was 600 arrobas (arroba, twenty-five pounds); that this year it will be 30,000, and next year will probably amount to 250,000 arrobas.

The accompanying map of the Beni is less than one-half of the river surveyed by the Doctor. His entire map extends from Reyes to the junction of the river with the Mamore—no portion of which had ever previously been located with instruments.

The Doctor writes that he will return home this fall for the purpose of organizing an expedition to explore the Madre de Dios, a much larger river and longer than the Beni. He proposes to begin his surveys at the ancient Inca capital of Cuzco in Peru and descend the Madre de Dios from its smallest beginnings. He desires to enlist in the undertaking a competent mineralogist, a geologist and a botanist. He plans to spend at least two years in the work, and besides the

work of exploration he hopes to discover rich deposits of the precious metals, new forests of cinchona trees, valuable textile and medicinal plants, in the low lands extensive forests of rubber trees, minerals, vegetables, and animals, new to science.

Dr. Heath is a true discoverer, and will always be numbered among the explorers of South America. He is endowed with those qualities that enable him to lay his plans wisely, and to execute them with a daring that fears no evil, and an endurance that overcomes all hardships. A cloud of superstitious fear rests for centuries on one of the fairest portions of a continent, and all men pause or pass around the *terra incognita*. A guard of ten Bolivian soldiers present their bayonets at the breast of a celebrated explorer who essays to penetrate the unknown region, and refuse to go further. Dr. Heath, in a canoe with two Indians, paddles his frail bark out into the unknown river, and, bidding adieu to the world behind him, passes safely through this region so full of terror.

In the exigencies of his expedition he discloses qualities of being that are rarely discovered, and mark the true explorer. We see him exercising his profession as physician and surgeon, administering to the sick in his immediate vicinity, to furnish the means necessary to carry out his expedition. When by the unskillfulness of an attendant, his canoe is upset in a dangerous river hundreds of miles from human habitations, and everything seems to be lost, his helpless attendants climbing upon a rock beside the rushing torrent and uttering a cry of terror,, we see him, not counting the cost, plunge into the whirlpool, and recover his lost paddles and supplies. When he needs a paddle and has no instrument to manufacture one, we see him charring the wood and rubbing off the carbonized portion with a stone until the rough wood is shaped into a paddle by this slow and novel process. A man endowed with such purpose, courage, endurance and ingenuity is surely fitted to be an explorer and discoverer. It was a fitting tribute that the school children of Reyes should go out to greet him, returning from his successful exploration, with songs and floral offerings.

There is only one part of the South American continent that remains to be explored—the lower portion of the Madre de Dios. Dr. Heath is now on his way to the United States, having formed the purpose of organizing an expedition to open this unknown river to civilization, and thus complete the exploration of the South American continent.

PHILOSOPHY.

A STUDY IN BIOLOGY.

BY PROF. H. A. REID.

The Psychic Calendar of Creation, by H. A. Reid, Secretary State Academy of Sciences, at Des Moines, Iowa.

To illustrate his lectures on "Evolution," "Science and the Bible," etc., approved and commended by the State Executive Committee of the Young Men's Christian Associations of Iowa.

[Calendar to be read from the bottom upward.]

SEXASENTIA	THE SPIRITUAL SENSE. HEARING SMELL SIGHT TASTE TOUCH	"Spiritual man" of the Bible. See John 3:6·7 Rom. 8:5 1 Cor. 2:14—15:46
QUINSENTIA	HEARING SMELL SIGHT TASTE TOUCH	Brute man, mammals, birds, and aerous reptiles.
QUADRISENTIA	SMELL SIGHT TASTE TOUCH	Humoid reptiles, and paleozoic sea saurians.
TRISENTIA	SIGHT TASTE TOUCH	Sauroid fishes, crustaceans, trilobites, worms.
DISENTIA	TASTE TOUCH	Protozoa, polyparia, radiates, mollusks.
UNISENTIA	TOUCH	Sensitive plants, rhizopods, pseudopoda, protoplasm: the eozoon.
INSENTIA	Organic forms, but no motative sensibility.	Primordial fucoids, and vegetation generally.
AZOIC PERIOD.	No vivific structures.	*Lifeless Elements.*

This calendar is a companion-piece to the geological chart which was published in the REVIEW for July, (page 138), and the editorial note on that (page 193) applies equally to this. The order of successional types of animal life, as tabulated here, is in some measure coincident with the order in the geological chart referred to; and although following an entirely different line and method of inquiry, it arrives at the same great fact at last—the perfect harmonization of the

law and philosophy of evolution with the grand distinguishing doctrine of the Christian Bible, that there is a "natural (or carnal) man," and there is a "spiritual man."

As confirmatory of the doctrine involved in the above calendar, I will make a few citations from writers whose eminent rank both as scientists and Christian men, no one can question.

INSENTIA AND UNISENTIA.

Prof. Rolleston, in "Forms of Animal Life," says: "But it must be said that there are organisms which at one period of their life exhibit an aggregate of phenomena, such as to justify us in speaking of them as animals, whilst at another they appear to be as distinctly vegetable. * * If it should prove to be true that organisms as high in the scale as the Amœbina and Actinophryna can have their development traced back to the specialization of protoplasm within vegetable cells, it would appear to be necessary to adopt a phraseology which should speak of such creatures as being at one time plants, and at another, animals."

Prof. Sanborn Tenney, late of Williams College, in his "Elements of Zoölogy," says: "It is pretty clearly demonstrated that all animals, even the highest forms, begin their embryonic existence as mere particles or aggregated particles of protoplasm, and that out of this 'primitive indifferent tissue,' as it has been called, all the cells and tissues, and parts of the animal body are evolved. * * It must be added here, however, that at its very beginning the ovum or egg itself is something even much simpler than a cell, being merely a minute particle of fluid matter—that is, mere protoplasm."—pp. 14 and 15.

Prof. James D. Dana, of Yale College, in his "Manual of Geology," which is the standard text-book in all our higher institutions of learning, says: "The system of life began in the simple sea-plant and the lower forms of animals, and ended in man."—p. 593 "The evolution of the system of life went forward through the derivation of species from species, according to natural methods not yet clearly understood."—p. 603.

"An animal without limbs, without any sense beyond the general sense of feeling; without a circulating system; without even a stomach except such as it may extemporize when needed, and with the work of digestion, respiration and reproduction performed by the same protoplasmic material that makes up the mass of the body of the infinitesimal Rhizopod, is, as to complexity of organization, but little removed from a germ; *and such*, we have reason to believe, *was the beginning of the system of animal life."—Dana's Manual* p. 595.

"The whole animal kingdom is the display of a few comprehensive structural types, the simpler forms of which appeared in early time, and the more complex came forth successively afterward. Some new organs were required in the highest manifestations of a type. But these were only developments through modification of the older, or better appliances evolved from the structure for carrying forward old processes."—*Dana*, p. 594.

Many other passages of similar import, and equally decisive, might be given. And yet, within a month past I have seen one of our leading religious newspapers, the *Christian Observer*, published at Louisville, Ky., quoting Dana's Manual of Geology, as scientific authority *against* the doctrine of evolution.

TRISENTIA AND QUADRISENTIA.

Trilobites are, so far as now known, the first animals that had eyes, although many of their species were without eyes—hence they are supposed to bridge over from the two-sensed to the three-sensed class—that is, from touch and taste to touch, taste and sight; yet all these senses must have been sluggish, feeble, and greatly generalized in this animal. Among the two-sensed animals must be classed at least one vertebrate, the Lancelet or *Amphioxus*, of which Prof. Tenney says: "It is the lowest of all the vertebrates. It is partially transparent, has no skeleton, no proper head, and only a mere longitudinal slit for the mouth, which is wholly destitute of jaws and teeth." Prof. Hæckel, from his profound studies in embryology, concludes that this creature is an intermediate form or true "connecting link" between worms and vertebrates; and there is no indication that it has any of the senses except touch and taste. And Prof. Tenney says even of our modern fishes, as to sight, "the iris neither contracts nor dilates, and the pupil is not altered, whatever be the quantity of light." As to hearing, "the ear of fishes is inclosed on every side in the bones of the head, and consists merely of a sac, re, resenting the vestibule, and of three membranous semicircular canals." The sense of hearing in these animals is therefore merely rudimentary. And the Professor further says, "the sense of taste, of smell, and of touch, are regarded as feeble." Again, in speaking of the Dinosaurs, he says, "they are of gigantic size, and they combine in their structure reptilian, bird-like, and mammalian characteristics." They, together with the Pterodactylæ, were aerous reptiles, and were pioneers of the

QUINSENTIA,

Or five-sensed animals, which includes also all mammals and birds. And man is commonly placed in this class; but the doctrine of evolution here joins interest and evidence with the Christian Bible, and gives to man a higher rank—a sixth-sense.

SEXASENTIA.

Prof. Dana (*Manual*, p. 579,) says: "Man is linked to the past through the system of life, of which he is the last, the completing creation. But, unlike other species of that closing system of the past, (significantly the zoic era of geological history,) he, through his *spiritual* nature, is far more intimately connected with the opening future."

Prof. Allman, a high authority in zoölogy, President of the British Association of Science, in his inaugural address, Aug. 20, 1879, says: "From the first dawn of intelligence there is with every advance in organization a corresponding advance in mind. Mind as well as body is thus traveling on through higher and still higher phases; the great law of *evolution* is shaping the destiny of our

race; * * who can say that in the far-off future there may not *yet be evolved other and higher faculties*."

Rev. Dr. Campbell, an eminent and very learned Scotch theologian and college professor, wrote in 1763 the only successful reply to the famous "argument against miracles" which had been put forth twelve years previously by the historian, David Hume; and Dr. Campbell says: "When we speak of the laws of nature, we commonly mean no more than those regarding the material world, or the laws of matter and motion with which we happen to be acquainted. Yet, those which regard spiritual beings *are as truly laws of nature* as those which concern corporeal."

Paley's "Natural Theology" has been a standard text-book in all theological seminaries for more than half a century past; and on page 231 it says: "There may be more and other senses than those which we have. There may be senses suited to the perception of the powers, properties and substance of spirits. These may belong to the higher orders of rational agents; for there is not the smallest reason for supposing that we are the highest, or that the scale of creation *stops* with us."

Prof. Winchell, the distinguished geologist of Michigan, and author of many popular works, says: "Evolution restores us to that simple conception of the relation of God to the world which is at once the primitive faith of man, the heaven-taught creed of the ancient Hebrew, and the loftiest result of modern science and philosophy."

The above citations are perhaps sufficient to indicate what is the plain logic of the law of evolution—that Man is an embryonic and transitional type, and not a closed or terminal type like the quadrumana and other lower forms. The idea was well grasped by many of the Bible writers which the logical sequences of known natural law confirm to-day, to-wit: Animal man is the larvæ of the angel; the "spiritual man" of the Bible is that transitional stage in which the angel consciousness has been more or less developed, while the larval form and mode of life still remains. And the first awakening of this angel consciousness in the man constitutes what is called "regeneration" by the churches.* The angel consciousness is a function of the spiritual or sixth-sense, which may be very dim or very bright, the same as the other senses. It furnishes its data as reliably as the other senses; but in this case as in the others, the coördinating reason must place them in their proper relation to other sense-given data, or else there will be aberrant predominance of the data furnished by the sixth sense, and thus lead to religious folly and fanaticism, the same as the excessive predominance of any other one of the senses will lead to erroneous thought and action.

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* "New birth," "change of heart," "born again," or "born of the spirit," "coming out of darkness into marvelous light," etc., are all phrases used in revival and other religious meetings, which, as practical facts, mean the same thing.

RELATIONS OF SCIENCE TO SPECULATION.

BY PRINCIPAL J. W. DAWSON, LL. D.

"Do we really exist? If we do, what is the thing called life?" Such are the problems that were discussed by Principal Dawson, of Montreal, a Fellow of the Royal Society and one of the best living scientists in the study of biology, in his lecture at Association Hall, Philadelphia. It was the first of a series of gratuitous lectures on "The Relations of Natural Science to Monastic and Agnostic Speculations," given under the auspices of the Crozier Theological Seminary.

If we ask, said the lecturer, what is science in relation to nature, we have before us all that men have observed of the workings and objects of nature and the deductions therefrom. But added to this is something of another sort, sometimes called philosophy, which is really a mass of material, the growth of the thoughts of the times, and this is that troublesome commodity—modern speculation. Evolutionists need the less complain of this view, as it is the natural outgrowth of their theory. It by no means follows that our knowledge of recent discoveries equals the extent of their practical application. Take, for instance, electricity. Its application in a variety of ways is almost general, and yet there are very few things we know less about, either as to its laws or by what it is regulated. There is so much discovery that men are in danger of thinking themselves omniscient, but in reality the most of the accomplishments of science remain mysteries to mankind. The tendency to mad specialties of study, too, cause a great deal of speculation, covering the whole field to be made, from a point of view that is really restricted. Then there has sprung up a demand for sensational science just as there has sprung up a demand for sensational fiction, and if it cannot be met by facts in existence, something has to be invented, for the number of the half-starved scientific men who are trying to find the secrets o nature is by no means small. Moreover a great deal of supposed scientific truth is vague and does not mean one-half what is supposed. I don't know to wha extent science is to be blamed, but not a few of those who have pushed specula tion to its utmost have been literary men, and some of them had studied theolog as well. An agnostic, you know, is literally one who doesn't know. As one o them has expressed the idea, "the existence of a God is unthinkable." Th agnostic, while saying less than the atheist, means scientifically more, and steel himself against argument by saying it cannot be reasoned about at all. In th true sense no scientific man can be an agnostic. There are few of us, perhaps who will refuse to accept the creed, "I exist," although there are some wh might limit it, and yet our personal existence is a thing most incomprehensible especially in regard to its beginning and its ending.

We are in a boundless space and time, with the beginning of either a mys tery, so that it is scarcely possible for any one to admit his own existence witl

out arousing a vestige of the religious idea. In personal existence is involved the question whether or not the vastly complex bodily organism is the first or only the outer shell. We cannot but admit that the body is vastly more mysterious since science took it up. There is a class of philosophers who think it will simplify matters to consider the individual as a material substance with two sets of properties. If by a material substance is meant a combination of elements there is no such material in existence having the qualities of mind; if it means the whole being, the statement amounts to nothing. We must admit there is something more, and that is life. Nutrition, reproduction, sensation and voluntary motion are its functions, the last two being restricted to animal life. Herbert Spencer says life is "the continuous adjustment of internal and external relations," but that is very vague and only touches the surface. I think myself that life has the same relation to organism that force has to matter. It is some energy, whether a combination of physical energies, or the same but correlated only with organization. It is all very well to find fault with calling the living organization "a machine," but a machine has to be made by some one and for a purpose, and there is an enormous lot of theism in the idea. Who ever heard of a machine made by nobody for nothing in particular? What is the use in talking about protoplasm as the basis of life when in point of fact protoplasm depends on life as its basis? All the white of an egg is protoplasm, but life is in the embryo cell. Protoplasm may go to make feathers and flesh and tissue, and yet the life that constitutes the chick may be elsewhere. Going further, science fails to correlate the power of the human will with any physical force. It is an energy that operates only on living organs and through them on other things. Then comes the question, are we the originators of the world, or did it produce us, or is there a great third Being? If an atom is a vortex, as they say, what is it a vortex of? We talk very learnedly of laws of nature, but they are but the expressions of the controlled motion of things. Behind them lies an insoluble mystery.

In conclusion Mr. Dawson discussed the three theories of Herbert Spencer as to the origin of things, "self-existing," or "self-created," or "created by external agency," and raised a laugh by saying that the possibility of creation by an agency within had never occurred to Mr. Spencer. Mr. Dawson's deduction was that science is not inconsistent with the view of a superhuman power explaining the origin, design and continuance of things.—*Philadelphia Times.*

THE NATURE OF THE EXISTENCE OF MATTER.

BY E. R. KNOWLES.

Philosophers are now obliged to refer all the phenomena of the material universe to the action of a substance occupying space, which connects the planets and the earth, and which communicates light, heat, electricity and gravitation, from one body to another, and mental emotion and imaginary ideas from one

mind to another. This interstellar, and indeed, omnipresent medium is called *Etherium*, or the Ether. Most scientific men are fully convinced of its reality. It is a necessary inference from the following facts:

1. The planets influence each other and are all influenced by the sun.

2. Philosophers agree that the atmosphere does not extend more than eighty miles above the earth's surface.

3. Heat, light, electricity, magnetism, and gravitation, operate in an exhausted receiver, as well as elsewhere.

4. One mind sometimes influences another independently of ordinary sensation or muscular motion, without contact or perceptible connection.

Says Prof. Tyndall, "The domain in which this motion of light is carried on is entirely beyond the reach of our senses. The waves of light require a medium for their formation and propagation, but we cannot see, or feel, or taste, or smell this medium. How, then, has its existence been established? By showing that by the assumption of this wonderful intangible *ether* all the phenomena of optics are accounted for with a fullness and clearness, and conclusiveness which leave no desire of the intellect unfulfilled. When the law of gravitation first suggested itself to the mind of Newton, what did he do? He set himself to examine whether it accounted for all the facts. He determined the courses of the planets; he calculated the rapidity of the moon's fall toward the earth; he considered the precession of the equinoxes, the ebb and flow of the tides, and found all explained by the law of gravitation. He, therefore, regarded this law as established, and the verdict of science subsequently confirmed his conclusion.

On similar, and, if possible, on stronger grounds, we found our belief in the existence of the universal ether. It explains facts far more various and complicated than those on which Newton based his law. If a single phenomenon could be pointed out which the ether is proved incompetent to explain, we should have to give it up; but no such phenomenon has ever been pointed out. It is, therefore, at least as certain that space is filled with a medium by means of which suns and stars diffuse their radiant power, as that it is traversed by that force which holds, not only our planetary system, but the immeasurable heaven's themselves in its grasp." To other kinds of ethereal action are referable muscular motion, sensation, and all other known phenomena, except the as yet inexplicable phenomena of consciousness and volition.

Says Prof. J. Stanley Grimes: "Light cannot penetrate boards and stone walls, but magnetic force can do so; for a magnet affects iron filings through such obstacles, almost as if there was nothing in the way; and so also does gravitation. It is plain that if we could perceive through the medium of this magnetic force instead of light, we could see through boards and walls as easily as the magnet operates through them; for the magnet operates in the dark just as well as in the light. We must conclude, therefore, from the great number of facts which we have upon this subject, that there is a motion of etherium, different from light, by means of which the force of gravitation is communicated; and another modification of ethereal motion, by means of which magnetism penetrates

through opaque bodies. It, therefore, requires no stretch of the imagination to admit a modification of ethereal force which affects the brain and its organs, and produces Consciousness and Clairvoyance in a subject who is, by the process of ethereal induction, brought into communication with it.

If we analyze a sunbeam, we can demonstrate that besides light and heat it contains another kind or motion of etherium, different from light and heat, which produces powerful chemical effects; and yet we have no senses given to us by which to enable us to perceive by its means, though it may sometimes abnormally induct us, and produce clairvoyant perception.

It seems to me that there cannot be a doubt in the mind of a philosopher who examines this subject carefully, that there is a peculiar form or modification of ethereal force, which has, with some propriety been denominated *animal magnetism*, and which is concerned in producing all the phenomena of animal life, and all the wonders of Etheropathy and Mesmerism. We seem forced to this conclusion as the only one which will account for facts which we are not able to controvert."

It is well known that orators often exercise a so-called magnetic influence over their hearers. It has been proved that mesmeric susceptibility is owing neither to the imagination, nor the credulity, nor the nervousness of the subject, and that when a subject is in a state of etheropathic sympathy produced by induction ideas can be communicated from the mind of the operator to that of the subject, and the subject made to act by the silent, unexpressed will of the operator, without any indication being given to the subject by the word, look, or deed of any one as to what the operator has in mind. These last mentioned facts have led some philosophers to suppose this ether of which light, heat, electricity and magnetism are manifestations, to be homogeneous with, or at least intimately connected with, that immaterial, simple substance, the soul.

The idea that the will of man can direct ethereal action in such a manner as to produce etheropathy, or mesmerism, is perfectly consistent with the nature of the will.

In the case of the electric eel, we have an instance of the will directing electricity in such a manner as to paralyze the limbs of animals at a great distance, and even to produce death. If, then, the electric eel can instinctively direct by its will *one* modification of ethereal action, it is reasonable to suppose that the will of man can direct *another*.

Absolutely nothing is *known* for certain concerning the real nature of substance.

In view of the facts herein already adduced, it is reasonable, and indeed the only way whereby to account for certain incontrovertible facts, to refer all things to immaterial substance, and to refer matter, as well as light, electricity, etc., to the simple, uncompounded, immaterial substance, called the *ether*. All the difficulties with which philosophers now meet in explaining various phenomena by the action of the ether arise from their not explaining the very existence of matter by ethereal action. "That which truly is, or essence," is the proper meaning of

substance. *Substance* is "the ultimate point in analyzing the complex idea of any object." *Accident* denotes all those ideas which the analysis excludes as not belonging to the mere being or nature of the object."

The substance of all matter is the *ether*. The accidents of any material thing are its peculiar modifications of ethereal action. The *ether* acts in space directed and compelled in its action by the Divine Will. They are:

1. Simple ethereal action, as electricity and light.
2. Combined modifications of ethereal action, constituting matter.

The *ether* exists independently of the Creator, but while this substance of all matter exists independently, the accidents of material things are constantly sustained by the Divine Will in accordance with fixed and permanent laws. This theory explains the phenomena of matter by the action of the *ether;* but it teaches neither that the ultimate reason of all movement is a force primitively communicated at creation, a force which is everywhere, present in all bodies but differently limited; not that any such force is inherent in the *ether;* nor yet that force is transmitted through the ether; but I hold that the Divine Will constantly sustains by sympathetic induction the modifications of ethereal action, both simple and combined.

At any point in space such action of the *ether* directed by the Divine Will *is ever going on*, that an object there situated has no real existence *there*, whether any one is there to perceive it or not, its real existence being a combination of certain modifications of ethereal action; and the same object is presented to every spirit which happens to be brought into communication with that point in space, this presentation being governed by fixed laws, and any one who has already perceived a particular object knows that upon going again to the place where it is, the same object, or combination of modifications of ethereal action will be communicated to his soul by means of the same ether as a medium and by certain other modifications, and combinations of modifications of ethereal action.

Our perception, therefore, of real ideas or material objects is the result of the action of the Divine Will on our minds through the medium of the *ether*, and the Eternal Spirit constantly sustains and presents these real ideas for the contemplation of "created spirits," but they have a real existence in space out of the minds which perceive them.

This theory does not merge the creature in the Creator; and does not make God the agent or power in everything that is done, and thereby lead us to the same point with Hume, viz: that the mind is but a mere series of impressions and that we can have no knowledge of it.

GEOLOGY.

THE CARBONIFEROUS ROCKS OF SOUTHEAST KANSAS.

BY G. C. BROADHEAD.

At the eastern boundary of Miami county, Kansas, we find the high lands to vary from 950 to 1050 feet above the sea, the valleys being 875 to 910. In the Neosho Valley the elevation at Neosho Falls is about 1000 feet. Up to this place and a little farther, we pass over a gently sloping country. It then rises more rapidly, being 1150 feet on higher land. West of the Verdigris the country rises more rapidly and is more rugged.

In Osage county coal is profitably mined, which, according to Prof. Mudge, belongs to the Lower Coal-measures. The Lower Coal-measures pass southwardly along the Neosho Valley, which seems to occupy a trough in these measures, but eastwardly, including Miami county, the northern half of Anderson and the county northwardly, only the upper series are exposed, connecting with similar measures in Missouri.

West of the Verdigris River the Upper Coal-measures also extend, but soon disappear beneath the "Permian." The main productive Coal-measures of southeast Kansas lie south of Miami county. Passing from Paola southwestwardly to Greenwood county, we find only a thin coal-seam occasionally mined, but with no profitable result. Near the line of Greenwood and Woodson counties a seam of less than a foot in thickness is sometimes mined. This is the most western exposure of coal belonging to the Carboniferous formation. In the western part of Woodson and in Greenwood counties the lowest exposed rock is fifty feet of coarse sandstone which I have referred to the Lower Coal-measures, but only a few fragmentary remains of plants were found in it. Above this are thin limestone beds full of *Fusulina cylindrica* and nearly 200 feet more of sandstone, with other limestone beds above, containing well known Carboniferous fossils, including *Fusulina cylindrica* and *Chœtetes*. The step now is more rapid to the "Permian."

Entering the State near the line of Cowley and Chautauqua counties, we find ourselves upon a long dividing ridge extending and well defined for seventy miles northwardly.

This ridge is much higher than the country east or west of it, and is known in southern Kansas as the "Flint Hills," on account of numerous fragments of flint lying strewn over the surface. It includes the Permian rocks of Kansas and might appropriately be termed the "Permian Mountains." Its elevation above the sea is 1560 feet near Greenfield, in northeast part of Cowley county 1600 feet; and the highest point near the corner of Greenwood, Elk and Butler about

1700 feet. This is the highest ground east of Arkansas and Walnut Valleys. On the west side of this ridge the descent is gentle and scarcely perceptible, being 390 feet in twenty-five miles to the Arkansas Valley. On the east the descent is more abrupt, the ridge presenting rugged walls of limestone separated by shaly slopes, and the hills descend 350 feet in four miles, or 390 feet in six miles, and in some places the descent is still more abrupt. From the main ridge sharp spurs extend off from six to ten miles eastwardly. From the peculiarly rough character of the eastern face of this ridge good wagon passes are often distant as much as ten miles.

The approaches to this ridge from Fall River Valley is by a succession of terraces or plateaus of Upper Carboniferous rocks. At Twin Falls we are on a lower terrace elevated about 1000 feet above the sea. The second terrace is reached six miles southwestwardly at 1160 to 1180 feet. This terrace occupies a large area of the eastern part of Greenwood county with most of Elk. The elevation of the next terrace is about 1300 feet above the sea and it reaches to the foot hills of the Permian and the slopes above blend with the Permain. This will include altogether about 500 feet of Upper Coal-measure rocks in this part of Kansas which lie below the Permo-carboniferous. These beds are mainly shaly sandstones with occasional limestone beds and as far as observed contain one coal bed of seven inches with two beds of bituminous shale, and one other coal seam of five inches thickness appears just beneath the Permian. The Permian or Permo-carboniferous of the "Flint Hills" include a total of about 500 feet thickness. The following section I have condensed from several taken within twenty miles.

1. Sixty-two feet including chert layers with thin beds of shaly drab-colored limestone; the highest rocks seen in "Flint ridges," observed *Bryozoa* with *Athyris subtilita*, *Productus costatus* and *Hemipronites crenistria*.

2. Ninety feet mostly thin limestone layers chiefly disintegrating on exposure.

3. Seven feet bed of porous chert resting on limestone. *Pinna peracute* found everywhere. A *Phillipsia* was also obtained.

4. Eighty-five feet chiefly drab shales with some thin layers of limestone and red shale near lower part. Fossils are very abundant and can be picked up in a finely preserved state, and include *Fistulipora(?)*, *Productus Nebrascensis*, *P semireticulatus*, *Meekella striaticostata*, *Chonetes graculifera*, *Terebratula bovidens* *Athyris subtilita*, *Yoldia subscitula*, *Schizodus Rossicus*, *Myalina perattenuata*, *Hemipronites crenistria*, *Aviculopima Americana*, and other known Upper Carboniferous fossils.

5. Five feet of bluish drab and sometimes buff limestone containing *Eumicrotis Hawni*, *Mayalina perattenuata*, *Aviculopecten occidentalis*. [This bed is easily recognized wherever seen.]

6. Ten feet red and green shales.

7. Fifty-three feet beds shale, with some beds of limestone very good for building purposes.

8. Twenty-eight feet limestone abounding in *Fusulina cylindrica;* the middle layers contain blue chert full of *Fusulinæ* showing the structure very finely.

9. Twenty-eight feet of sandstone.

10. Four feet gray limestone containing *Productus semireticulatus*, *Allorisma granosa*, *A. subcuneata*, *Pinna peracuta*, *Nautilus capax*, etc.

The last bed I regard as the base of the Permian.

Other fossils obtained at the several localities include *Allorisma subelegans*, *A. Topekaensis*, *Macrodon* —, *Nautilus occidentalis*, *Murchisonia* —. Although these fossils seem at home in the *Permian*, I have obtained them also, with scarcely an exception, from known Upper Coal-measure rocks of Missouri; in fact most of them have been obtained from the rocks of Kansas City.

The limestones of the Permian have been extensively quarried in Kansas from the southern to the northern part of the State, and many tons sent off to the market. Some of the rock quarried is too soft for valuable structures, but many very excellent quarries have been opened.

From levels taken on corresponding beds wide apart, we find there is a regular dip, westwardly, of not less than twenty-five feet per mile. Assuming this to be correct we may be safe in saying that there are 1500 feet total thickness of Permian beds in southern Kansas. In the counties of Butler, Cowley, Elk and Greenwood, it is the *newest* rock below the *Quaternary*. No other rocks of later formation than the Permian are found here. The Permian of Kansas rests *conformably* on the *Coal-measures*, and there is no decided line of separation between the two. Certain strata can be grouped together as can certain other strata of other formations.

The only marked difference is this: Passing a certain horizon in the ascending series, we find the rocks to be all of a drab, buff or cream color and the limestones more impure and breaking with a rough fracture, and when vertically jointed the angle more nearly approaches a right angle, whereas the Coal-measure limestones are generally more acutely jointed and the blocks are regular rhomboids.

The group of the Permian Mountains forms an interesting study; the strata are easily traced and the scenery afforded is very fine and the view extensive.

The above is an abstract of a more detailed paper.—*American Journal of Science.*

From the nodule of chromite in the interior of the meteorite iron of Cohahuila, Mexico, Dr. J. Lawrence Smith, of Louisville, Kentucky, has obtained, on analysis of it, 62.61 of oxide of chromium and 33.82 of ferrous oxide.

METEOROLOGY.

TABLES OF METEOROLOGICAL OBSERVATIONS.

The following tables of Meteorological Observations have been furnished us by Dr. E. R. Heath, the explorer of the Beni River:

MONTH.	YEAR.	RAINFALL.		FAHRENHEIT THERMOMETER.				PLACE.
		Quantity.	No. Days	High't Max.	Low't Min.	MEAN OF Maximum.	MEAN OF Minimum.	
January	1879	15.000	23	97°	70°	87.996°	72.666°	San Antonio
"	1880	9.231	14	94	72	87.$\frac{2}{31}$	77.$\frac{27}{31}$	Reyes
February	1879	10.245	22	94	70	88.$\frac{5}{28}$	72.571	San Antonio
"	1880	5.576	9	94	69	87.000	72.100	Reyes
March	1879	16.412	24	94	70	87.$\frac{28}{31}$	71.$\frac{28}{31}$	San Antonio
"	1880	6.145	9	92	70	84.$\frac{12}{31}$	76.$\frac{16}{31}$	Reyes
April	1879	11.339	21	94	68	88.440	72 100	San Antonio
"	1880	.765	2	86	65	79.$\frac{18}{29}$	72.$\frac{11}{29}$	Reyes.
May	1878	3.800	11	97	58	86.600	69.600	San Antonio
"	1879	1.040	9	94	59	88.$\frac{5}{31}$	68.$\frac{30}{31}$	"
"	1880	5.145	4	88	64	81.$\frac{1}{9}$	71.$\frac{1}{9}$	Reyes
June	1878	.436	6	97	65	87.500	67.$\frac{1}{5}$	San Antonio
"	1879	2.315	5	93	62	90.$\frac{1}{30}$	69.$\frac{7}{30}$	"
"	1880	3.888	9	88	54	80.$\frac{26}{31}$	69.$\frac{2}{30}$	Reyes
July	1878	.010	1	96	57	91.$\frac{1}{6}$	66.$\frac{1}{5}$	San Antonio
" to 21st.	1879	.000	0	93	60	91.500	64.$\frac{17}{20}$	"
* " 21st to 31st inc	1879	.000	0	94	65	90.000	68.$\frac{2}{9}$	Cachuelas
"	1880	.000	0	90	61	86.$\frac{7}{31}$	70.$\frac{18}{31}$	Reyes
August	1878	.535	2	98	59	92.$\frac{4}{31}$	68.500	San Antonio
† "	1879	1.002	2	98	52	90.$\frac{16}{31}$	66.$\frac{21}{31}$	Cachuelas
"	1880	1.730	3		58			Reyes
Sept'ber	1878	1.395	5	101	60	90.$\frac{1}{3}$	68.500	San Antonio
‡ "	1879	4.100	5	96	55	87.$\frac{7}{13}$	69.$\frac{2}{13}$	R. Mamore and Sta. Ana to Reyes.
"	1880	.905	4					Reyes
October	1878	8.265	16	99	67	90.$\frac{1}{3}$	69.$\frac{26}{31}$	San Antonio
"	1879	7.654	11	95	65	86.$\frac{12}{31}$	71.$\frac{26}{31}$	Reyes
"	1880	2.140	5					"
Novem'r	1878	9.145	13	94	68	89.$\frac{1}{27}$	67.$\frac{4}{9}$	San Antonio
"	1879	7.275	9	94	68	88.$\frac{29}{30}$	74.$\frac{28}{30}$	Reyes
"	1880	6.530	12					"
Decem'r	1878	11.301	21	94	66	88.$\frac{23}{30}$	72.$\frac{4}{15}$	San Antonio
"	1879	10.769	13	94	72	86.$\frac{15}{31}$	75.$\frac{5}{31}$	Reyes
"	1880	1.280	3					

* San Antonio to Girao. † Girao to Itenez (Rio). ‡ R. Itenez to Exaltacion, Sta. Ana and Reyes.

MONTH.	YEAR.	BAROMETERS. Aneroid.	BAROMETERS. Mercurial.	THERMOMETER FAHRENHEIT attached to the Mercurial Barometer.	LOCALITY.
January	1880	1662.7415′	28.9301″	80.2092°	Reyes
February	1879		29.0820	81.2678	San Antonio
"	1880	1592.7145	29.0777	78.2077	Reyes
March	1879		29.1733	80.6290	San Antonio
"	1880	1538.1442	29.1147	79.7820	Reyes
April	1879		29.2028	80.3333	San Antonio
"	1880	1455.0516	29.2404	76.3244	Reyes
May	1879	1122.7419	29.2603	78.6370	San Antonio
"	1880	1512.6875	29.1916	74.4250	Reyes
June	1879	1098.9582	29.3089	79.2000	San Antonio
"	1880	1419.5416	29.2254	74.4916	Reyes
July	1879	1084.3600	29.4671	77.5000	San Antonio
21st to 31st.	1879	1152.8124	29.3707	77.6041	San Antonio to Girao
"	1880	1468.7499	29.1957	77.3548	Reyes
August	1879	1211.3325	29.4090	76.7500	Girao to R. Itenez
* "	1880	1409.5739	29.1320	78.0282	Reyes
September	1879	1278.7500	29.3510	83.2857	R. Itenez, Sta. Ana to Reyes.
† "	1880	1374.9333	29.2260	75.5930	Reyes
October	1879	1507.7750	29.1514	78.5200	"
‡ "	1880	1360.2342	29.1724	78.2445	"
November	1879	1631.1600	29.0636	81.8666	"
§ "	1880	1644.6979	29.0789	79.7193	"
December	1879	1626.4100	29.0457	78.6774	"
"	1880	1860.9649	29.0794	79.5085	"

Lat. 8° 48′ 14″ South, (Selfridge,) San Antonio.

Lat. 14° 16′ 34.5″ South, (E. R. Heath,) Reyes.

Long. 63° 55′ 05″ West of R, (Selfridge,) 64°38′ 08″ (Keller,) San Antonio.

Long. 68° 22′ 52″ West of R, (E. R. Heath,) Reyes.

Var. Mag., Reyes, 9° 12′ E. (Nov. 2, 1879), San Antonio, 5° 56′ E. (E. R. Heath).

A mysterious star, called the Pilgrim, which was observed in 945, 1264 and 1572, is expected by astronomers to appear before long. It was described in 1572 as brighter than Jupiter, and "such was its brilliancy that persons were able to detect it at noon in a clear sky, and at night when the sky was so overcast as to hide all other stars." If it appears it will probably be visible for several weeks in the constellation of Cassiopeia.

* Aneroid observations made on the Beni River between Lats. 14° 15′ 56″ and 10° 20′ S.
† Aneroid observations made on the Beni and Mamore Rivers between Lats. 10° 20′ and 13° 44′ 04″ S.
‡ Aneroid observation to October 11, inclusive.
§ Aneroid observations from October 11, inclusive.

ASTRONOMY.

ASTRONOMICAL NOTES FOR SEPTEMBER, 1881.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.		Declination N.		M. T. Meridian Passage.			
1st,	10h,	43m.	8°	4′	11h.	59m.	44.07°	a. m.
5th,	11	58	6	36	11	58	26.02	"
10th,	11	16	4	42	11	56	43.54	"
15th,	11	34	2	47	11	54	58.16	"
20th,	10	52	0	51	11	53	12.59	"
25th,	12	10	S. 1	05	11	51	29.19	"
30th,	12	28	3	02	11	49	50.09	"

On the 22nd at 4 P. M. its center will pass the celestial equator and autumn commence. The apparent diameter is slowly increasing.

THE MOON.

Date.	Right Ascension.		Declination South.		Apparent Diameter.	
1 st,	16h.	39m.	22°	23′	31′	43.2″
5th,	20	40	14	05	33	17.8
10th,	1	18	N. 12	28	32	17.2
15th,	5	49	22	08	30	03.0
20th,	9	50	7	45	29	37.0
25th,	13	42	S. 14	18	30	37.8
30th,	18	24	21	13	32	02.4

On the 15th at 5 A. M. it will be 51′ south of Mars. The best time for telescopic observations will be from the 12th to the 16th, and from the 28th to the end of the month.

MERCURY.

Date.	Right Ascension.		Declination North.		M. T. of Meridian Passage.		
1 st,	10h.	51m.	9°	8′	0h.	7m.	p. m.
5th,	11	18	6	2	0	18	"
10th,	11	50	2	6	0	31	"
15th,	12	20	S. 1	45	0	42	"
20th,	12	49	5	27	0	51	"
25th,	13	17	8	56	0	58	"
30th,	13	43	12	10	1	05	"

It will be to the east of the Sun during the entire month. The most favora ble time for seeing it will be about the 29th when it will set in 1h after the sun at a point 10° south of west. On the 24th it is 3° 25′ south of the moon.

VENUS.

Date.	Right Ascension.		Declination North.		M. T. of Meridian Passage.		
1st,	8h.	05m.	19°	32′	9h.	23m.	a. m.
5th,	8	25	18	45	9	26	"
10th,	8	49	17	34	9	30	"
15th,	9	13	16	12	9	34	"
20th,	9	36	14	37	9	38	"
25th,	10	00	12	52	9	42	"
30th,	10	23	10	58	9	46	"

She now occupies the position of morning star rising about 2h. 20m. before the sun. The *verse sine* of the illuminated portion, divided by the apparent diameter 13.4″ = .884.

MARS.

Date.	Right Ascension.		Declination North.		M. T. of Meridian Passage.		
1st,	5h.	7m.	22°	21′	6h.	22m.	a. m.
5th,	5	17	22	36	6	16	"
10th,	5	29	22	53	6	08	"
15th,	5	41	23	06	6	01	"
20th,	5	52	23	16	5	52	"
25th,	6	03	23	24	5	43	"
30th,	6	13	23	30	5	33	"

It will be in the constellation Taurus until the 15th, then enter Gemini, where it will remain to the end of the month. The apparent diameter is slowly increasing, the mean being 9″ for the month.

JUPITER.

Date.	Right Ascension.		Declination North.		M. T. of Meridian Passage.		
1st,	3h.	35m.	18°	08′	4h.	49m.	a. m.
5th,	3	36	18	10	4	33	"
10th,	3	37	18	11	4	14	"
15th,	3	37	18	11	3	55	"
20th,	3	37	18	09	3	35	"
25th,	3	36	18	06	3	14	"
30th,	3	35	18	02	2	54	"

On the 14th it will be stationary *i. e.* its right ascension does not change for a short time. Its diameter is about 43″

The four satellites present the following phenomena in Kansas City Mean Solar time. The abbreviations used are, In. ingress; Eg. egress; Dis. disappearance; Re. reappearance; Ec. eclipse; Oc. occultation; Tr. transit of the satellite; Sh. transit of the shadow.

DATE.				DATE.			
3d,	11:27 p. m.	Io,	Sh. In.	18th,	3:15 a. m.	Io,	Sh. In.
4th,	12:47 a. m.	Io,	Tr. In.		4:27 a. m.	Io,	Tr. In.
	1:39 a. m.	Io,	Sh. Eg.	19th,	12:24 a. m.	Io,	Ec. Dis.
	2:58 a. m.	Io,	Tr. Eg.		3:45 a. m.	Io,	Oc. Re.
5th,	12:06 a. m.	Io,	Oc. Re.		9:44 p. m.	Io,	Sh. In.
	9:26 p. m.	Io,	Tr. Eg.		10:54 p. m.	Io,	Tr. In.
7th,	12:22 a. m.	Europa,	Sh. In.		11:56 p. m.	Io,	Sh. Eg.
	2:58 a. m.	Europa,	Sh. Eg.		1:05 a. m.	Io,	Tr. Eg.
	3:00 a. m.	Europa,	Tr. In.	20th,	10:12 p. m.	Io,	Oc. Re.
	10:34 p. m.	Ganymede,	Sh. Eg.	23d,	12:43 a. m.	Europa,	Ec. Dis.
8th,	2:13 p. m.	Ganymede,	Tr. In.	24th,	9:06 p. m.	Europa,	Tr. In.
	3:32 a. m.	Ganymede,	Tr. Eg.		9:28 p. m.	Europa,	Sh. Eg.
	10:03 p. m.	Europa,	Ec. Re.		11:38 p. m.	Europa,	Tr. Eg.
	10:07 p. m.	Europa,	Oc. Dis.	25th,	8:11 p. m.	Ganymede,	Ec. Re.
9th,	12:40 a. m.	Europa,	Oc. Re.		11:13 p. m.	Ganymede,	Oc. Dis.
10th,	1:21 a. m.	Io,	Sh. In.	26th,	12:25 a. m.	Ganymede,	Oc. Re.
	2:38 a. m.	Io,	Sh. Eg.		2:18 a. m.	Io,	Ec. Dis.
	10:30 p. m.	Io,	Ec. Dis.		11:38 p. m.	Io,	Sh. In.
12th,	1:56 a. m.	Io,	Oc. Re.	27th,	12:42 a. m.	Io,	Tr. In.
	9:05 p. m.	Io,	Tr. In.		1:50 a. m.	Io,	Sh. Eg.
	10:02 p. m.	Io.	Sh. Eg.		2:53 a. m.	Io,	Tr. Eg.
	11:19 p. m.	Io,	Tr. Eg.		8:47 p. m.	Io,	Ec. Dis.
14th,	2:57 a. m.	Europa,	Sh. In.		12:00 a. m.	Io,	Oc. Re.
15th,	12:44 a. m.	Ganymede,	Sh. In.	28th,	7:09 p. m.	Io,	Tr. In.
	2:35 a. m.	Ganymede,	Sh. Eg.		8:19 p. m.	Io,	Sh. Eg.
	10:07 p. m.	Europa,	Ec. Dis.		9:20 p. m.	Io,	Tr. Eg.
	3:17 a. m.	Europa,	Oc. Re.	30th,	3:19 a. m.	Europa,	Ec. Dis.
17th,	9:15 p. m.	Europa,	Tr. Eg.				

SATURN.

Date.	Right Ascension.	Declination North.	M. T. of Meridian Passage.
1st,	2h. 42m.	13° 8′	3h. 56m. a. m.
15th,	2 41	12 58	2 59 "
30th,	2 39	12 42	1 58 "

The apparent elements of the ring on 17th are diameter of outer Major Axis 44.06″, Minor Axis 15.04″, inclination of northern semi-minor axis to circle of declination from north to east 307′, elevation of the earth above the plane of the ring 19° 57.8′, elevation of the sun 18° 44.3′, earth's longitude from Saturn counted on the plane of ring from the rings ascending node equator 94° 04.2′ on ecliptic 51° 19.6′.

URANUS.

Date.	Right Ascension.	Declination North.	M. T. of Meridian Passage.
1st,	11h. 02m.	7° 2′	0h. 17m. p. m.
30th,	11 08	6 20	10 26 a. m.

NEPTUNE.

Date.	Right Ascension.	Declination North.	M. T. of Meridian Passage.
1st,	2h. 58m.	15° 4′	4h. 11m. a. m.
30th,	2 56	14 55	2 16 "

PHENOMENA.

On the 3d at 1 a. m., conjunction of Uranus and Mercury. Mercury north 57′; near the sun.

On the 6th at 10 a. m., conjunction of Uranus and the Sun.

On the 12th at 00.17 a. m., conjunction of Saturn and the Moon. Saturn south 5° 17′.

On the 13th at 00.16 a. m., conjunction of Jupiter and the Moon. Jupiter south 2° 38′.

On the 15th at 7:29 a. m., conjunction of Mars and the Moon. Mars north 0° 51′.

On the 25th at 7:00 p. m., conjunction of Venus and Regulus. Venus north 0° 12′.

THE NEW COMET.

The comet discovered by Professor Schaeberle, of Ann Arbor, July 13th (Comet C, 1881), is now visible through an opera glass, and will soon be to the naked eye. Its identity is still uncertain; most probably there is no record of its previous appearance. It is expected to be one of the most conspicuous comets of the century. Under date of July 22nd, Mr. Henry M. Parkhust says: "It may not equal Gould's comet in brightness, for the nucleus may not be brighter than the north star, and yet it is not uncommon for the brightness of a comet after passing its perihelion to much exceed that computed from its appearance before its perihelion passage. It has already developed a tail as marked as that of Donati's comet an equal time before its perihelion passage, and it would now be visible to the naked eye but for the presence of the moon, although perhaps not distinguishable from a star. Up to the 15th of August the comet will be visible in the morning in a direct line between Aldebaran and Theta Ursa Major, being now midway between them. On August 15th it will be near Theta, with its tail pointing toward the north star. It will then cease to be visible in the morning, not rising until after twilight begins. It now sets at the same time with the sun, but will gradually set later, so that it will become visible in the evening before it is entirely lost in the morning. On August 19th it will be near Nu Ursa Major, with

its tail pointing toward and perhaps reaching Gould's comet, then visible only in the telescope in the Little Dipper. On August 25th it will be in the constellation Coma Berenices, the tail probably passing over or near Arcturus. Early in September the comet and its tail will both pass below our horizon, still as bright as Coggia's comet at its best."

Prof. Swift says, under the same date: "Of course it is impossible yet to predict with certainty, but it would seem as if it would eclipse the glories of Comet B" (Gould's Comet).—*Scientific American.*

MINERALOGY.

IRON SAND.

On the shores of New Zealand, and many other localities, there are vast quantities of iron sand, which might be profitably utilized. In the last edition of Simmonds' "Waste Products," (pp. 413-419), some detailed information on the New Zealand iron sands will be found.

One of the American contributions for the Electrical Exhibition at Paris is a modification of Mr. Edison's magnetic separator for the treatment of iron sand. The iron sand on the south shore of Long Island contains 26 per cent of the finest iron known. Innumerable attempts have been made to separate the sand, and magnetic plates have been used before, but with no success, on account of the presence of what is known as titaniferous iron—a substance which spoils iron. Edison discovered that titanic iron was less magnetic than the pure iron particles, and constructed his separator with that end in view.

The sand falls a distance of four feet in a thin stream from a slit in a V shaped box holding about a ton. Under this box is a receiver divided into two compartments, the dividing partition being placed nearly under the slit in the sand reservoir and parallel to it. If no magnet is brought into play the sand all falls into one side of the box: but when a powerful magnet is brought near enough to act upon the falling showers, the pure iron particles are deflected in their fall and fly on the other side of the partition. The particles of titanic iron are not attracted equally with the iron, and are not deflected sufficiently to fall into the compartment with the pure iron.

A company has been formed in America for the extraction of iron from Long Island sand, and is now at work with its first machine at Quoque, near Moriches, on the Great South Bay. This machine, which is managed by one boy, keeps six men and two carts busy bringing sand for the hopper. It treats 100 tons of sand a day, producing about 20 tons of pure iron, costing a dollar a ton to produce, and selling for six dollars.—*Journal of Applied Science.*

MICA.

While speculation in mica mining is rife, there are few mines that prove paying investments. Nothing is more common than mica deposits in some form, but nothing is more uncommon than to find a mine which will yield a good profitable return for the money invested. Nature has been very capricious regarding this mineral, and out of some two hundred mines in this country, it is not probable that over half a dozen approach anywhere near "Bonanzas." Even suppose the mine to yield mica in sufficient quantity, there are several features in the business which tend to diminish profits. In the first place, of the mica taken from the mine about five per cent is worthless; opaque mica is not a merchantable article and must be thrown aside. Afterward when the mica is cut into required sizes there occurs a shrinkage of from 40 to 60 per cent. The mica trade hinges on the stove business, for in stove doors does mica find its chief use. It has a very limited use for scientific purposes, electrical apparatus, compass cards, lanters, etc. It is employed for battle lanterns on war ships, for the concussions incident to naval engagements would soon shatter glass. All these uses, however, are insignificant compared with its application to heating apparatus.

Were not the production of mica limited to Nature's stores which she very sparingly doles out, there would have undoubtedly been new uses discovered for the mineral long before this. New Hampshire and North Carolina furnish most of the mica required, though deposits exist over a wide stretch of territory, and the mineral has been found as far west as the Rockies. The Indians were acquainted with it, and used it for ornaments to adorn their persons, and for mirors to reflect their dusky charms. On opening a mine in North Carolina some years ago, a copper instrument supposed to be at least three hundred years old was found. There has been much small mica thrown on the market in recent years, and prices of this kind have declined, but large mica, being scarce, maintains its price. The number of farmers in Maine, New Hampshire and Vermont who have discovered mica deposits on their estates, and who have seen prospective wealth therefrom, is legion, but the number who have really profited by their discoveries is very small.—*Manufacturers' Gazette.*

The California lode is down to a depth of 1300 feet, the deepest mine in Colrado. The 1300-foot station has been established, from which levels are driving oth ways—east and west. The mid-dirt from this depth is yielding five and a alf ounces gold per cord. This practically demonstrates the fact that deep mining ill pay. The smelting ore from the 1300-foot levels is fully up to the former andard of that ore mined in the upper workings of the vein.

HISTORICAL NOTES.

EARLY NOTICES OF THE MISSOURI RIVER AND INDIANS.

(SECOND PAPER.)

BY JOHN P. JONES, KEYTESVILLE, MISSOURI.

In the year 1712, Louis the XIV, conveyed the commercial privileges c Louisiana to Anthony Crozat, "Secretary of the household crown and revenue, and in describing the boundaries of the grant, attempted to change the nam of the three greatest rivers in the province, as follows:

"We, by these presents, signed by our hand have appointed, and do a point the said Sieur Crozat to carry on a trade in all the lands possessed by u and bounded by New Mexico, and by the English of Carolina, all the port rivers, havens, and particularly the river St. Louis, heretofore called the *Missi-sippi*, together with the river St. Philip, heretofore called the *Missouri*, and S Gerome, heretofore called Oubache (Ohio), with all the countries, territorie lakes, etc."

The name St. Louis, as applied to the Mississippi, was in use for some year but it is a matter for congratulation that the Indian names of these three gre rivers have survived all attempts of the white man to change them. Surely Missourian will regret that our noble river is not called St. Philip, even though Bourbon prince should have desired to perpetuate in that manner the name "our dearly beloved cousin."

As the great resources of the Mississippi Valley became known, the Engli began to turn their attention in that direction. Some of their writers claim th an English vessel ascended the Mississippi as early as the year 1648, but of tl there is no evidence. Others assert that expeditions from the English colon on the Atlantic coast traversed the valley prior to the year 1700. Individ parties may have crossed the mountains and sailed down the Ohio prior to tl date, but there is no written evidence of any organized expedition from t coast into the valley between the date of its occupation by La Salle and the vent of Iberville at the mouth of the Mississippi.

The first recorded visit of Englishmen to the valley by the way of the M sissippi was in the year 1699.

In that year Bienville while making a survey of the river, about eight miles below where New Orleans now stands, was surprised to see two ves bearing English colors, making their way up stream. They proved to be un the command of Captain Barr, and had come on a voyage of discovery. U the representation of Bienville that the country was already in possession of

French, the English captain returned to the gulf. The promoter of this expedition was Daniel Coxe, a gentleman of wealth, living at London, who sent several exploring parties into the valley afterward, and from the reports received from them, prepared and published a volume,* describing the country. Of the Missouri he says: "The great Yellow River to the west is so named because it is yellow and so muddy that, though the Meschacebe is very clear where they meet, and so many great rivers of crystalline waters below mix with the Meschacebe, yet it discolors them all even into the sea. When you are up this river sixty or seventy miles you meet with two branches, the lesser, though large, proceeds from the south and is called the river of the Osages, from a numerous people who have sixteen or eighteen towns seated thereon, especially near its mixing with the Yellow River. The other, which is the main branch, comes from the northwest. The Yellow is called the River of the Massorites, from a great nation inhabiting many towns near its junction with the River of the Osages."

In another place he says: "It will be one great conveniency of this country if it ever comes to be settled, that there is an easy communication there with the South Sea which lies between America and China, by the north branch of the great Yellow River, by the natives called the River of the Massorites, which hath a course of 500 miles, navigable to its heads or springs, and which proceeds from a ridge of hills, passable by a horse, foot or wagon in less than half a day, somewhat north of New Mexico. On the other side are rivers, which run into a great lake, that empties itself by another great navigable river into the South Sea." This was written nearly one hundred years before the expedition of Lewis and Clarke by which it was proven that the Missouri and Columbia have their sources within a few miles of each other and might be quoted as additional evidence that the Indians of the valley visited the Pacific coast.

By the peace of Utrecht, in 1713, England obtained from France large concessions of territory in America, but Louisiana remained untouched, though many of the leading spirits in the colonies urged that the valley of the Mississippi be included in the acquisitions of the mother country. William Penn, Governor Spottswood, of Virginia, and the assembly of New York, addressed the queen on the subject but without result. During the war preceding this peace, some of the northern tribes influenced by emissaries of the English, besieged Detroit with the intention of burning it. The Jesuit fathers stationed there, summoned their Indian allies from the chase, and by the middle of May the besiegers were surrounded by Hurons, Pottawatomies, Illinois, Osages and Missouris, who hastened to the relief of their priests, so widespread was the influence of the missionaries in the west. They came in war parties, and camping near the post sent in a delegation encouraging those within, and saying to the priests, "Father, behold thy children compass thee around."† They soon compelled the surrender of the besiegers, putting to death those who bore arms, and distributing the remainder as slaves among the confederates.

* A description of the English province of Carolina, by the Spaniards, called Florida, and by the French, La Louisiane; by Daniel Coxe, Esq., London, 1726. † Charlevoix's History of New France, Vol. II.

Among the early writers on the Louisiana country none are more interesting than Lieutenant Dumont, who spent twenty years in the colony. In the first volume of his Historical Memoirs he says, "I am going to give here the list of all the names of the savage nations, inhabiting this country. The asterisk which will be found before some of their names, denotes that we are actually at war with the nations thus marked." He then gives a list of the Indian tribes, and among others the Missouris are marked with an asterisk. Following the list he says, "The savages which on this list are not noted by an asterisk, are reckoned among our friends, but mark this, however, that though they may be friends, it is always wisest not to trust one's self to them fully."

Another French annalist, M. LePage DuPratz, whose history has proven a mine of information for later writers says, in writing of the Missouri River: "The Missouri takes its source at 800 leagues as well as can be ascertained from the place where it empties in the St. Louis. Its waters are muddy, troubled and charged with niter, and it is because of these waters that the St. Louis is so muddy to the sea. The reason of the color is that the former flows over sand and firm ground, while the latter takes its course across fertile lands where one sees but few rocks, and although the Missouri comes from a mountain toward New Mexico we must remember that all the country through which it passes is for the most part rich soil. This river not having been ascended by the French but a short distance about three hundred leagues at most, the branches which empty in it are only known to the natives. It makes no difference what names they bear at present, being in a country little frequented. The best known of these is the Osage, which takes its name from a nation which dwells on its banks; it empties in the Missouri River near its mouth. The largest known river which falls into the Missouri is the Canzes. It has nearly two hundred leagues course through a beautiful country. From what I have been able to learn of the course of the Missouri, it flows from its source to the Canzes from west to east, there it makes a great elbow which ends in the neighborhood of the Missouris, where it retakes its course toward the southeast, there to lose its name and waters in the St. Louis."

This extract is from the pen of one of the best informed men in the colony at the time it was written, and shows that the information possessed by those, who from their position would be presumed to be well informed concerning the Missouri was very meager, even as late as the middle of the last century. The same writer continues, "The waters of this river of the Missouri, are always thick and muddy and it seems that its source is not far from the place where, on the map of M. de Lisle, they make Fort Dauphin, or the sea of the west." This sea of the west was an imaginary lake that M. de Lisle located in the northwest part of this map of Louisiana from information derived from Indians. It is possible they were attempting to describe Salt Lake.

Under date of November 17th, 1750, Father Louis Vivier wrote from Kaskaskia as follows: * "Mississippi signifies Great River in the Illinois language

* Lettres Edifantes, Vol. VII.

It appears to have usurped this denomination over the Missouri. Before its junction with this river the Mississippi is not considerable, it has very little current while on the contrary the Missouri is larger, deeper, more rapid, and takes its source from a greater distance. Several large rivers flow into the Mississippi, but it seems the Missouri alone furnishes more water than all the others together; here is the proof, the water of the greater part, I might say of all the rivers that the Mississippi receives, is but moderately good, that of some positively unwholesome, that of the Mississippi even before its alliance with the Missouri, is not of the best. On the contrary, the water of the Missouri is the best water in the world. Now, that of the Mississippi after its junction with the Missouri, to the sea, becomes excellent. Therefore, the water of the Missouri must be dominant."

How any one acquainted with the waters of the two rivers could write in this manner, I cannot understand, and I, therefore, conclude that the father derived his information from others as to the excellency of the water of the Missouri.

At another place Father Vivier says: "Among the nations of the Missouri some appear to have a disposition particularly inclined to receive the gospel, among them the Panismahas. One of the missionaries of whom I have spoken wrote one day to a Frenchman who traded with these savages, and he begged him in his letter to baptize the dying children. The chief of the village perceiving this letter said to the Frenchman 'what is the news?' 'Nothing,' he responded. 'What!' said the savage, 'because we are red men can we not know the news?' 'It is the Black Gown,'* answered the Frenchman, 'who writes to me, and recommends that I baptize the dying children to send them to the Great Spirit.' The chief perfectly satisfied said to him: 'Do not be uneasy, I will take upon myself the task of informing you always, when any child shall be in danger.'"

On the 3rd day of November, 1762, the King of France ceded to Spain all the country known as Louisiana. In February, 1763, a treaty of peace was signed at Paris between the Kings of Spain and France on one side and the King of Great Britain on the other, by which all of the province of Louisiana east of the Mississippi, except New Orleans, was ceded to the latter power. After the promulgation of this treaty the French authorities were loyally willing to surrender the country to the English, but the Indians showed a disposition to resist them.

The Illinois, Missouri and Osage tribes, in a council held at Fort Chartres, in October, 1765, breathed nothing but war. The chief of the Kaskaskias addressed the English agent, who had come to receive possession of the fort, as follows:

"Go hence and tell your chief that the Illinois and our brethern will make war upon you if you come upon our lands. Away, away, and tell your chief that these lands are ours, no one can claim them, not even the other red men. Why will you come here, you do not know us, we have never seen you. Tell

* The Jesuit Missionaries were called Black Gowns, by nearly all the western tribes.

your chief to stay on his own land as we do on ours. Adieu! Go and never return, or our wild warriors will make you fall."

"We," said the chiefs of the Missouris and Osages, "think like our brethren, the Illinois and we will aid them to keep their lands. Why, O Englishmen, do you not remain on your lands as the red men do on theirs. These lands are ours, we hold them from our fathers. They lived upon them and now they are ours. No one can claim them of us, therefore, depart. Begone! begone, and tell your chief the red men will have no Englishmen here. Begone, never to return."*

Such was the frenzy the Indians had worked themselves up to, that the English agent was in personal danger and owed his safety to the circumspection of St. Ange†, who remained as the respresentative of the French. Ross, the English representative was obliged to descend to New Orleans, leaving the French still temporarily in possession of the Illinois district.

In 1766, Matthew Clarkson a merchant of Philadelphia made a journey over land to Fort Chartres on the Mississippi, and in a diary in which he recorded incidents of the trip he mentions the Osages as follows: December 23rd, 1766, a party of Osages came to the fort, Tawanahet, the chief. Mons. Jeredot,‡ the elder who has been a trader for many years among the Indians informed me that the Osages live on a river of the same name which falls into the Missouri from the southward. That they have about —— men capable of bearing arms. He says that they have a feast which they generally celebrate about the month of March, when they bake a large corn cake of about three or four feet in diameter and of two or three inches in thickness. This is cut into pieces from the center to the circumference, and the principal chief or warrior arises and advances to the cake, where he declares his valor and recounts his noble actions. If he is not contradicted or no one has aught to allege against him he takes a piece of cake and distributes it among the boys of the nation, repeating to them his noble exploits and exhorting them to imitate them. Another then approaches, and in the same manner recounts his achievements and proceeds as before. Should any attempt to take of the cake to whose character there is the least exception, he is stigmatized and set aside as a poltroon."

Feasts were frequently observed among nearly all the Indian tribes, and generally had some peculiar significance. Some of the southern tribes had a special feast for every month, among the number there was one called the Green Corn Feast, which occurred in May. Among some of the tribes on the Missou

* The noted warrior, Pontiac, was the chief instigator of this opposition to the English. He was present at this council with four hundred warriors from the lakes, and declared that if the English were permitted to take possession of the fort he would destroy it.

† A Canadian officer, prominent in the early history of the Mississippi Valley. He was at Fort Orleans in 1724, but retired to Kaskaskia before the massacre at that post. After the surrender of the eastern part of Louisiana to the English, he, with most of the French, removed from Fort Chartres and Kaskaskia, to Laclede's new post of St. Louis, where his name is perpetuated in a street called St. Ange Ave.

‡ Jean Baptiste Girardeau, or as spelled by himself, Girardot. The ancestor of the family whose name is perpetuated in the name of a town and county in our State.

River there was a feast celebrated at which the maidens participated, and which resembled the feast of the Osages, except that in the former case it was the character of the maidens for chastity that underwent the ordeal of a challenge. The knowledge of the Louisiana country possessed by the English in the last century was very limited indeed, and an examination of their histories proves that they depended upon French sources for their data. Thos. Jeffreys published at London, in 1760, a large volume entitled "The Natural and Civil History of the French Dominions in North and South America," but all he says of the Missouris and Osages is taken from Charlevoix and has already been given.

Bowen's Geography published in London, in 1760, says in describing the boundaries of Louisiana "Neither are those on the northwest less uncertain. The Missouri, a great river which gives name to a vast tract of land, flows from that point into the Mississippi." In enumerating the Indian tribes in Louisiana, the author does not mention the Missouris or Osages, but locates them on his map. In 1770, Captain Phillip Pittman published at London, a work entitled "The Present State of European Settlements on the Mississippi," in which he says: "The source of the Missouri River is unknown. The French traders go betwixt three and four hundred leagues up to traffic with the Indians, who inhabit near its banks. From the confluence with the Mississippi to its source, it is supposed to be eight hundred leagues."

MEDICINE AND HYGIENE.

TREATMENT OF HAY-FEVER.

Dr. Hermann Hager, who has observed a case of catarrh with subsequent asthmatic trouble and loss of appetite, which closely resembled the hay-fever of England and the United States, thought of trying his *catarrh-pills* (I.), prepared after the following manner:

℞	Quinidiæ Sulphatis	10.0 gm.
	Tragacanthæ	4.0 "
	Althæa rad.	1.0 "
	Gentian rad	8.0 "
	Glycerin	7.0 "
	Acid. hydrochloric	7.0 "

M. Make 200 pills. Take 3 every two hours.

(Comp. also *New. Rem.*, 1880, 243; 1881, 254.)

The condition of the patient improved in the course of the first day, and on the second day the patient was well. Six months afterward the attack again occurred, but yielded readily to the same treatment.

Hager thinks that hay-fever is caused more probably by the dust or spores of fungi, than by the pollen of phænogamous plants.—*Pharm. Centralhalle*, No. 18.

COOKERY FOR INVALIDS.

The following, from a recent English journal, contains some hints which form a suggestive appendix to former articles that have appeared in our columns on this important subject:—

Give the distasteful food the semblance of something that is particularly palatable to the patient, and your efforts will be rewarded by your soon beholding him eating with an appetite. For instance, you are bound to give mince, and equally bound not to give pastry. Your patient, however, is fond of pastry. What you must then do is this: You must make a *vol-au-vent* case, and fill it with minced chicken or lamb. Then, though your patient may not eat a single mouthful of the crust, the look of the whole thing calls up the pleasurable feelings associated with the *vol-au-vent*, in lieu of the feeling of disgust excited by a dish of mince. On this day you will find that he enjoys his meal; on another occasion you can surround the mince with a wall of mashed potatoes or boiled rice. Again, you may send up your mince in the guise of a "cottager's pie." This, as every one knows, is just a layer of minced meat placed at the bottom of a small pie dish, covered with a three-inch layer of potatoes, put in the oven and nicely browned. Yet, again, you may put the mince into rissoles, or roll it up inside batter, or, failing all these, can make three-cornered sandwiches with it. In this last case the mince should be of chicken, and, instead of buttering both pieces of the bread, you might spread the faintest *soupçon* of potted ham on one of them.

In catering for such an invalid as we have in view, our aim is to get him to take a stipulated amount of meat per diem. The doctor has ordered him so many ounces a day, to be given in any form (save the solid) in which he can be induced to swallow it. As long, then, as this quantity gets taken, our object is secured. We may give it, if we like, through the medium of soup, or through that of meat jellies. It is quite possible, therefore, to let two, or even three, days in the week pass without mince in any one of its Protean shapes being present. We can make chicken panada, and put as much as is equivalent to the specified number of ounces into a plate of soup; or, again, we can make some strong ox tail jelly, and administer a couple of glasses to him; and then, when we have given the due allowance of meat, we are able to include in that day's *menu* things which are more appetizing, though less nourishing, than the mince. We can give him a souffle flavored with vanilla, served in a smoking tin, with a snowy white napkin around it. Charlotte russe, macaroni with sweet sauces, roast apples (to be eaten with baked milky rice pudding), stewed pears covered with cream, and innumerable other puddings can be given with great benefit, since

by causing your invalid to derive pleasure from some portion at least of his meal, you prevent him from regarding all eating as distasteful.

But, above all, it must be remembered that the way in which things are served is the most important element in the matter. The trays should be covered with the freshest of cloths, and even be rendered bright by a vase of flowers. You should never set a plate before an invalid containing the exact quantity of meat, fish, or pudding you want him to eat. If you do, he will be sure to leave half, with the complaint that he has no appetite. He should always have everything served on small dishes, and should be allowed to assist himself. His vegetables and sauces should never be heaped on his plate, but should come up in tiny vegetable dishes and pretty sauce-boats. Above all, he should never be told beforehand what he may expect, so that his meals have all the charm of a surprise. In short, an invalid's meals should be so managed that he should look forward to them with pleasure as to a break in the day's monotony, instead of turning from them with disgust, as from some disagreeable ordeal to be undergone with all the resolution he can muster.—*Boston Journal of Chemistry.*

ALCOHOL IN THE ARMY.

A careful study of the effect of the "spirit ration" in the British army was lately made by a writer in the *British Medical Journal.* His conclusions were as follows:

(1.) Spirits are not an absolute necessity in the field.

(2.) Given before or during a march, or work of any description, they are nearly always calculated to harm.

(3.) The only case in which exception need be made to the above rule is when men are near the end of a long and fatiguing march, which it is necessary should be accomplished. Then the issue of a spirit ration may probably supply the necessary stimulus for completing the work; but it must be on the condition that no further work shall be demanded until after a sufficient period of repose.

(4.) The issue of a ration at night, when work is done, may be useful as a sedative, and in inducing calm and refreshing sleep.

(5.) Under any of these circumstances, the ration ought not to exceed two ounces and a half (half a gill) of spirits—equal to one ounce and a quarter of alcohol; and it ought to be given well diluted with water—hot, if possible.

Even in cases where its utility is, with limitations, admitted, it is still a question whether extract of meat might not be better, as it certainly would be attended with less chance of evil result, should it not accomplish the immediate end contemplated. Admitting, however, that in cases where rapid stimulus is required alcohol is more useful than any of the proposed substitutes, there seems to be no valid ground for continuing its issue on campaigns as a regular ration. It would be better to carry it as an extra, and issue it only by the advice and with the concurrence of the medical officer.

SUMMER DRINKS.

The London *Chemist and Druggist* gives the following recipes for these seasonable beverages:

1. GINGER BEER.

Brown Sugar	2 pounds
Boiling Water	2 gallons
Cream of Tartar	1 ounce
Ginger, bruised	2 ounces

Infuse the ginger in the boiling water, add the sugar and cream of tartar; when luke-warm, strain, then add one-half pint of good yeast. Let it stand all night; then bottle. If desired, a lemon may be added, and it may be clarified by the white of one egg.

2. LEMON BEER.

Sugar	1 pound
Boiling Water	1 gallon
Lemon, sliced	1
Ginger, bruised	1 ounce
Yeast	1 teacupful

Let it stand from twelve to twenty hours, after which it may be bottled.

3. HOP BEER.

Sugar	4 pounds
Hops	6 ounces
Water	q. s
Ginger, bruised	4 ounces

Boil the hops for three hours with five quarts of water, then strain; add five more quarts of water and ginger, boil a little longer, again strain, add the sugar, and when lukewarm add one pint of yeast. After twenty-four hours it will be ready for bottling.

4. SPRUCE BEER.

Hops	2 ounces
Sassafras, in chips	2 ounces
Water	10 gallons

Boil half an hour, strain, and add:

Brown Sugar	7 pounds
Essence of Spruce	1 ounce
Essence of Ginger	1 ounce
Pimento, ground	½ ounce

Put the whole in a cask, and let cool; then add one-half pint of yeast, le[t it] stand twenty-four hours, fine and bottle it.

RELATION OF FOUL AIR TO CONSUMPTION.

"Experiment has shown that if an animal be kept confined in a narrow, closed apartment, so that the air supplied is always more or less vitiated by the carbonic acid which it expires, however well fed that animal may be, tubercle (consumption) will be developed in about three months." If this be the case, a large percentage of cases of consumption should be met with among the inmates of badly ventilated schools. But, fortunately, the disease is comparatively infrequent under the age of fifteen, and added to this is the protecting influence of the active exercise in the open air usually indulged in by school-children. It is upon the teachers that its blighting effects are most apparent, as they are predisposed by age, they neglect exercise in the open air, and *their mental labor is severe, and worry of mind exhausting*. Of eleven teachers who died during the last eight years within the limits of one county in Pennsylvania, two died of acute disease, one of an overdose of an habitual narcotic, and of nine attacked by consumption, eight died—six ladies and one gentleman; the other, a gentleman, will recover, at least for a time.—*From "Schoolroom-Ventilation," by Dr. P. J. Higgins, in Popular Science Monthly.*

SCIENTIFIC MISCELLANY.

THE PRESIDENTIAL COLD AIR MACHINES.

The apparatus which proved most satisfactory in cooling the chamber of the wounded President, was furnished by a Mr. Jennings, of Baltimore. It was devised for use in a new process of refining lard. According to the inventor's description the apparatus consists of a cast iron chamber, about ten feet long, three wide and three high, filled with vertical iron frames covered with cotton terry or Turkish toweling. These screens are placed half an inch apart, and represent some three thousand feet of cooling surface. Immediately over these vertical screens is placed a coil of inch iron pipe, the lower side of which is filled with fine perforations. Into a galvanized iron tank, holding 100 gallons of water, is put finely granulated or shaved ice (and salt when a low temperature is required). This water is sprayed upon the sheets in the lower tank constantly. In each end of the iron chamber are openings thirteen inches square. To the outer end of this chamber is a pipe connecting with an out-door air conductor. To the opposite end is connected a similar pipe leading into an ice chamber at its top, and from the bottom of the same a pipe leads to a small exhaust fan, and from the fan the now cold and dry air is forced direct into the President's room through a flue some twenty feet in length. Air at 99° temperature to-day is supplied at the rate of 22,000 cubic feet per hour at the register in the President's room at 54°, and

with the windows and doors open the temperature at the President's bed (twenty-five feet away) is maintained steadily at 75° day and night. When the cold air machine was introduced, it was intended to keep the windows and doors closed; and under these conditions the machine would create and maintain a temperature of 60° in the hottest weather without using the auxiliary ice-air chamber now used, which was the suggestion of Professor Newcomb and Major Powell, to meet the requirements of cooling the room with the doors and windows open. The closing of them gave the room an air of gloom. An extra ice-chamber fan and engine has been put up in a room opening into the hall near the first apparatus, to be used in case of accident, and to cool the corridors of rooms adjoining the President's.—*Scientific American.*

Professor Lowe recently gave a practical illustration of his cooling system at Norristown, of which we give the following account:

The apparatus of the company's office consists of a tin tube something over a foot in diameter, which opens into the outer air on the south side of the building. Thence it runs into the basement where it is conveyed into a sort of box or wheel house, containing and wholly inclosing a fan, which is revolved by a small engine. From the fan the pipe is conducted into a large wooden chest containing ice, and from the chest it is carried to a room on the first floor of a capacity of nearly 9,000 cubic feet, about the size of the President's chamber. By the motion of the fan the current is drawn in from the outer air, and driven through the ice chest to the room above. An entrance to the latter is effected by the simple process of passing the end of the pipe through a perforated board placed under the sash of a window.

At half past five o'clock the professor commenced operations. He took a "hygrometer" or instrument for measuring at once tbe heat and dampness of the air. When the fan commenced to revolve, the heat of the room, as indicated by the dry thermometer, was 83°, it having been cooled by a previous experiment in the morning. A stream of cold air poured in through the tube, and in four minutes the mercury fell to 77°. In eight minutes it reached 75°, and the hygrometer showed that the air, which at the beginning of the experiment had contained eight grains of moisture to the cubic foot, now contained only four and a half. As it grew colder it became more dry. Walking up into the pattern shop, Prof. Lowe found a carpenter planing cedar boards, and ordered him to put some of the shavings into a basket and set it in one of the compartments of the cooling chambers. Instantly a pungent and agreeable scent of cedar diffused itself through the room.

"Sitting here," said Mr. Lowe, "I can carry you through all the glens and groves of the country. All that I want is a few pine boughs, cedar branches and slips of mountain foliage. You can enjoy the temperature and odors of them all."

As he spoke the dry thermometer stood at 70½ and the wet one at ten degrees lower. The engine was running at its lowest possible rate, and the fan was making about 300 revolutions a minute. He placed the hygrometer in the mouth of the tube, where it received the full benefit of the cold air. The dry thermometer quickly fell to 65½°. It was then 6 o'clock, and the moisture was only two and one-half grains to the cubic foot. The room had grown so cold that summer clothing was uncomfortable, and the temperature was steadily maintained. At 6:25 a thermometer placed outside the building indicated 90° in the shade, and one in the center of the room 68°.

The apparatus furnishes 80,000 cubic feet per hour, and makes no perceptible noise in running. It is so arranged that ventilation can go on without passing the air over the ice, whenever the natural temperature is found sufficiently cool; or so that a part of the air can be cooled on its way in, and mixed with the natural atmosphere, whereby exactly the degree of temperature desired may be maintained without stopping the machine. It is controlled by the simple pulling of a cord by an attendant in the room.

A compact portable apparatus containing its own power has been devised by Prof. Lowe, which can be attached at a few hours' notice to any building, and used in cooling and ventilating either the entire building or any single room.—*Norristown Herald.*

ORIGIN OF LIFE INSURANCE.

Among the nations of antiquity, the Romans were the first to make an effort to arrive at a law of mortality. To this they were led indirectly by their highly developed system of jurisprudence. It became necessary at times to fix the value of life estates, *i. e.*, property owned during lifetime only, without the right of alienation or bequest, and to do so the probability of life had to be estimated. It appears that the method in common use was about equivalent to assuming that all persons who attain the age of thirty would certainly live to the age of sixty, and then certainly die. This purely arbitrary assumption was probably accepted by jurists as the simple solution of a difficult problem.

A great improvement was introduced by the Prætorian Prefect Ulpianus, one of the most eminent of Roman jurists. He published a table of mortality, in which a distinction was made between the different ages, and the probable number of years of life for each given. The rate of mortality assumed for the middle ages approximates to that probably prevalent previous to the seventeenth century. Whether this table was based upon actual observation or was purely speculative is not settled; but, if its estimates were correct, the chances of life above sixty years were very poor indeed among the Romans. However, these early efforts do not seem to have exercised any influence toward a proper investigation of the subject, and, having been forgotten they only possess a passing interest for us.

METEOROLOGICAL REPORT FROM JULY 20, TO AUG. 20, FROM OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA, KAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The principal characteristic of the weather from July 20th to August 20th, was the extremely high temperature which was specially noticeable from August 1st to August 20th. From the excessive heat on the 17th, one case of sun stroke is reported.

The precipitation of this month has not been sufficient to maintain the extensive crop prospects of this section. There being only .99 in. of rainfall since July 20th, and 1.43 in. from July 1st to August 20th. Highest temperature 106° on the 17th. Lowest temperature 39° on the 15th.

Highest barometer 29.17 on the 30th. Lowest barometer 28.81 on the 21st. Highest velocity of wind 35 on the 21st. Miles traveled by wind 7,737. A great many meteors were noticed from 9 P. M. to 12 on the 30th. The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Ju'y 20th to 30th.	Aug. 1st to 10th.	Aug. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min.	65.3	69.1	67.4	67.3
Max	87.0	95.8	94.0	92.3
Min. and Max	76.0	82.5	80 7	79.1
Range	21.5	26.6	26 6	24.9
TRI-DAILY OBSERVATIONS.				
7 a. m.	71.1	78.3	76.2	75.2
2 p. m.	80.9	94.0	91.3	88.7
9 p. m.	75.0	82.4	78.5	78.6
Mean	76.8	84.7	81.1	80.2
RELATIVE HUMIDITY.				
7. a m.	.78	.70	.77	.75
2 p. m.	.61	.48	.65	.58
9 p. m.	.70	.61	.70	.67
Mean	.69	.63	.72	.68
PRESSURE AS OBSERVED.				
7 a. m.	29.09	29.05	28.98	29.04
2 p. m.	29.07	29.01	28.94	29.01
9 p. m.	29.06	29.00	28.98	29.01
Mean	29.07	29.02	28.96	29.02
MILES PER HOUR OF WIND.				
7 a. m.	5.3	3 4	11.3	6.7
2 p. m.	10.1	12.8	13.9	12.3
9 p. m.	6.5	5 5	11.4	7.8
Total miles	2563	2081	3093	7737
CLOUDING BY TENTHS.				
7 a. m.	4.3	1.2	5.7	3.7
2 p. m.	7.0	2.8	5.0	4.9
9 p. m.	3.2	0.6	1.5	1.8
RAIN.				
Inches	.41	0.03	0.55	.99

RAILWAY AND CANAL TRANSPORTATION.

Eastward of Chicago and St. Louis a vast network of railways disputes the precedence with any and all other routes of transportation. There is now a fiercer rivalry than ever before. On Canadian soil the Grand Trunk Railway parallels the St. Lawrence system of canals, and extends beyond their Montreal terminus as far to the east as Quebec and Portland. The western terminus is overlapped by the distance between Port Colborne and Detroit, Sarnia, Collingwood, and other upper lake ports. At Collingwood, a friendly railroad relieves the steamers of freight that they so recently carried through the Welland, and delivers it to other parties or to the Grand Trunk at Toronto. In 1878, grain to the value of $272,803 passed over this route for the eastern or foreign market. In 1879, the value of grain transported was $1,536,351. This remarkable increase of traffic is to receive the attention of the United States government as a matter affecting the collection of customs and the interest of American shippers in general.

PHYSICS.

THE STORAGE OF ELECTRICITY.

Sir William Thomson, who is one of the highest living authorities, amply confirms the statement that a small box containing 1,000,000 foot-pounds of electric force has been conveyed from Paris to Glasgow. This small box was in reality a Faure secondary battery, in which the electricity can be accumulated and stored until it is required for use. By the application of the same kind of battery M. Faure has run a bicycle, and has also applied the principle to a small boat which has been successfully tried near Paris. Sir William Thomson has tested this battery, and reports that it does really afford a means of storing electrical force —a fact which is of vital interest and importance to the public. As we have previously pointed out, the great defect of dynamically-created electricity has been its existence only so long as the motive power was kept running. When the engine stopped the current ceased. Under the new plan this is no longer the case, and, as the eminent scientist named points out, the electric energy may be stored for household or other purposes, just in the same manner as water or gas. In this way we may light our houses, or utilize the electricity as power, under absolute control, and with a minimum of trouble and expense. Such being the case we may expect to witness an enormous development of the applications of electricity, assuming, of course, that the Faure battery is capable of indefinite reproduction on a practical scale. There are not wanting those who entirely dispute the value of the invention, and who ridicule the ideas set forth by Sir William

Thomson. Prof. Osborne Reynolds, of Owens College, Manchester, for instance, points out that, after all, 1,000,000 foot-pounds is a very small matter, being in fact just as much "energy" as is contained in 1½ ounces of coal. Coal, indeed, is to be our standard, according to Mr. Reynolds, and he predicts the utter failure of the plan for storing electricity. Professor Ayrton also comes forward as a critic, albeit one of a milder type. He admits the truth of the statement that 1½ ounces of coal contains 1,000,000 foot-pounds of energy, but he very pertinently asks how that force is to be extracted to its full extent. As a matter of fact it is impossible to attain that result, no known engine being capable of working with so minute a quantity of fuel. This is exactly where the difference lies. The coal may contain the power, but it is all latent, and not available without the aid of a much greater force than its own, whereas the electricity is all immediately available, and can be used wholly or partially at will. Besides this the coal once used is done with, whereas the Faure accumulator can be stored anew, and drawn upon as required. This is an essential distinction, and would seem to show that the criticism of Professor Reynolds is wholly beside the mark. Professor Ayrton intimates that himself and Mr. Perry are making attempts to convert at a low temperature the energy in coal into electric energy, and Sir William Thomson admits that if carbon could be extracted in this manner the result would be analogous to what is done by the Faure accumulator. So far, however, M. Faure alone has achieved success, and it is to his apparatus, therefore, that we must look for the speedy, practical solution of one of the great problems of the day. —*Ironmonger*.

CORRESPONDENCE.

NOTES FROM "CORRESPONDENCE SCIENTIFIQUE."

PARIS, July 12th.

The "Correspondence Scientifique" is a lithographed fac-simile of the articles on scientific subjects prepared for early information of the press and of individuals, by Chas. Varey, scientific editor of *La Presse*, a leading journal of Paris.

The last number received, dated the 12th *ultimo*, has articles under the following headings: "Optical Telegraph," from which it appears that the French military authorities have only recently brought into practical use, the Signal System adopted, perfected and most successfully used in the Union Army, through the latter part of the civil war.

"Hygienic Properties of Electric Illumination." An interesting article of which a translation is given below.

"Zoölogical Exploration of the Mediterranean." Giving latest results achieved by the Scientific Commission on board the national vessel "Travailleur," then in the Gulf of Lyons. Among other things the drag has discovered large Gorgons of the genus Isis, of an unknown species taken at a depth of 650 yards which offered to the explorers a marvelous spectacle; they emitted from their entire bodies, a green phosphorescent light of such intensity that when the animals were disturbed they seemed to produce a shower of fire. In the middle of one of the darkest nights it was possible to read by it (*ainsi*) very fine print.

"A Manufactory of Prehistoric Flints." Translated below.

"Dangers of Celluloid." In which it is stated that this product at first made from "camphor with an inexplosible cotton powder," is since made from compressed paper and mineral oil and has become inflammable and dangerous, and has already caused a great number of accidents.

"Pictures (Scenic?) of the Grand Opera." The celebrated work of a distinguished artist, Paul Bandry, observed to be obscured by the products of the combustion of gas used for illumination; it has been decided by the Minister of Public Works to substitute the electric light.

"Detective Ballot-Box." Describing a new style of glass ballot-box, proposed to be adopted in a law under discussion by the General Assembly. By means of special mechanism it permits an absolute check upon the number of ballots deposited, and renders easy to everybody to verify the number of votes cast at every moment of the day.

HYGIENIC PROPERTIES OF ELECTRIC ILLUMINATION.

The question of the hygiene of illumination in closed apartments, having lately been discussed by the Society of Natural Sciences, of Brunswick, Prof. Plasius and Doctor Hoppe have expressed their opinions upon the hygienic qualities of electric illumination.

After our contemporary "La Lumire Electrique," from whom we borrow the following details, Prof. Plasius remarked upon the advantages of electric illumination in respect to freedom from the injurious products of combustion, and that it does not offer as does gas, danger of explosion. In electric illumination, though there is combustion of carbon, the quantity of carbonic acid produced is excessively low, besides which, it produces no other deleterious gas.

Dr. Hoppe afterward gave account of his experiments upon variations of visual accuracy and the (comparative) facility of perception of colors under influence of different modes of illumination. It results from this study that in general visual sharpness is greater under gas than under daylight (?) and still more so under the electric light. With the latter illumination one recognizes red, green, blue and, above all, yellow, at much greater distance than by daylight. By gaslight colors are distinguished more easily than by day, but less easily than by electric light; yellow only being less visible under gas than under daylight.

After other observations of less importance the members arrived at this conclusion that to the present the hygienic qualities of electric illumination are insufficiently appreciated.

A MANUFACTORY OF PREHISTORIC FLINTS.

As evervbody knows alimentary articles to the last are falsified; old furniture and antique faiences are imitated with a perfection causing the despair of true amateurs; but until now they have dared to touch prehistoric objects only very timidly. That seemed to be an industry, impossible of exploitation, with success and profit.

A sugar refiner of Picardy, ornamented with the pre-name of Polydorus, has proved less hesitating; to the refining of sugar, he decided to add a factory of *Cibelots* of ancient ages. The stone age appeared to him an excellent epoch to cause to fructify, in Picardy above all, which is much thronged by archæologists and anthropologists. Then this was an industry, the founding of which, exacted no great amount of capital, the handiwork and the first material are so low priced. A grindstone and some flints, and the manufacture is started.

By this means, as simple as ingenious, our Picardian Polydorus has sold at high price to an archæologist of the environs of Beauvais a varied collection of flint arms, a collection composed of a thousand objects, hatchets, knives, arrowheads, etc., as coming from a sepulcher discovered in a quarry.

The Anthropological Society of Paris, to whom these were submitted as an extraordinary find, found them, despite their beauty, despite their perfect imitation, of an authenticity no little doubtful. A commission was named to work new trenches in the neighborhood of the sepulchres from whence proceeded the objects in question. They discovered nothing like sepulchres of the stone age but M. Mortillet, president of the commission, whose competency in questions of this nature is well known, had no delay in making another discovery, which wa that M. Polydorus was a brazen-faced " mystificator."

We relate this story to put collectors on guard against such frauds.

ANOTHER PREHISTORIC MAN.

Some human remains, evidently of great antiquity, says the *Academy*, wer discovered a few months ago at Carabacel, near Nice, and have been reporte upon by a local scientific committee, as well as examined by M. de Quatrefages The bones had not been artificially interred, but were found embedded in a deposit of calcareous clay, at a depth of about nine feet from the surface. This deposit was irregularly stratified, and contained a mixture of pliocene and eocen shells, showing that it had been formed by the reconstruction of the pre-existir strata. Of the bones the most remarkable is the lower jaw. This is sufficientl characteristic to enable De Quatrefages to refer it to the Cro-Magnon type. Tl fossil man of Nice, therefore, belongs to the same race as M. Riviere's skeletc from Mentone, both being probably of Paleolithic age.

PROCEEDINGS OF SOCIETIES.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SYNOPSIS OF THE PROCEEDINGS OF THE THIRTIETH ANNUAL MEETING.

This Association met August 18, 1881, in Music Hall, Cincinnati, Ohio, in the presence of a large audience composed of the *savans* of this country, with many from abroad. The great organ of the hall first gave forth a magnificent voluntary, rendered in a masterly way, by Mr. Winthrop Sterling. Prof. George J. Brush, of the Yale Scientific School, then called the meeting to order. The retiring President, Mr. L. H. Morgan, of Rochester, being absent on account of sickness and advanced age, the usual address from this officer was omitted. Rev. Dr. Ridgaway, of Cincinnati, and Ex-Secretary J. D. Cox, delivered an address of welcome, which was replied to by President Brush. A very large list of members elected at a previous business meeting was then announced.

In the afternoon session the various sections and sub-sections met in their respective rooms and proceeded to elect officers for the current year.

In Section A, after the election of its officers, Chairman Mallery read an able paper on the Gesture Speech of Man, of which the following is an abstract:

Anthropology tells the march of mankind out of savagery in which different peoples have advanced in varying degrees, but all started in progress in civilization from a point lower than that now occupied by the lowest of the tribes now found on earth. The marks of their rude origin, retained by all, are of the same number and kind, though differing in distinctness, showing a common origin to all intellectual and social development, notwithstanding present diversities. The most notable criterion of difference is in the copiousness and precision of oral speech, and connected with that, both as to origin and structure, is the unequal survival of gesture signs, which it is believed once universally prevailed. Where sign language survives, it is, therefore, an instructive vestige of the pre-historic epoch, and its study may solve problems in philology and psychology. That study is best pursued by comparing the pre-eminent gesture system of the North American Indians with the more degenerate or less developed systems of other peoples.

The conditions and circumstances attending the prevalence, and sometimes the disuse, of sign language in North America were explained. The report of travelers that among Indians, as well as other tribes of men, some were unable to converse in the dark, because they could not gesture, is false. It is the old story of *barbarian*, applied by the Greeks to all who did not speak Greek, repeated by Isaiah of the "stammering" Assyrians, and now appearing in the term

slav (speaker), as contradistinguished by the Russians from the Germans, whom they stigmatize as *Njemez* (tongueless).

The theory that sign language was the original utterance of mankind does not depend upon such tales or prejudices. After the immeasurable period during which man has been upon the earth, it is not probable that any existing peoples can be found among whom speech has not obviated the absolute necessity for gesture in communication between themselves.

The assertion made that the sign language of Indians originated from some non-defined tribe or region supposes its comparatively recent origin, whereas the conditions favorable to its development existed very long ago and were co-extensive with the territory of North America occupied by any of the tribes. Numerous evidences were presented as to its antiquity and generality. But the signs are not now, and from the nature of their formation never were, identical and uniform. The process is the same as among the uninstructed deaf mutes when associated together, which was explained.

A comparison sometimes made of the diversities of the sign language of the Indians with the dialects and provincialisms of the English language, is incorrect, as there is so small a proportion of the sign-using tribes which make identically the same signs, express the same ideas, and also because the signs are not absolute and arbitrary as are the words of English.

Sign language, as a product of evolution, has been developed rather than invented, but each of the separate signs had a definite origin arising out of some appropriate occasion, and the same sign may thus have had many different origins due to identity in the circumstances. No signs in common use were at first conventional. What may appear to be conventional largely consists in the differing forms of abbreviation which have been adopted. Yet, while all Indians, as well as all gesturing men, have many signs in common, they use many others which have become conventional in the sense that their etymology and conception are not now known or regarded by those using them. The conventions by which such signs were established, occurred during long periods and under many differing circumstances. Our Indians, far from being a homogeneous race and possessing uniformity in their language, religions and customs, differ from each other more than all the several nations of Europe, and their semiotic conceptions have correspondingly differed.

Instances were presented of the ascertained permanence of some Indian signs, and those of foreign peoples and deaf mutes. Though they, as well as words, animals and plants, have had their growth, development and change, those which are general both among Indian tribes, and are also found in other parts of the world, must be of great antiquity. Many signs but little differentiated were unstable, while others that have proved to be the best modes of expression have survived as definite and established.

The Indian system as a whole was compared with those of foreign peoples—the ancient Greeks and Romans, the modern Italians, the Turks, Armenians and

Koords, the Bushmen of Africa, the Rijangs and Lelongs of Sumatra, and the Australians. The result is that the so-called sign language of Indians is not, properly speaking, one language, but that it and the gesture systems of the deaf mutes and of all peoples constitute together one language, the gesture language of mankind, of which each system is a dialect. The generic conformity is obvious, while the occasion of specific varieties can be readily understood.

The most interesting light in which Indians, as other lower tribes of men, are to be regarded is in their present representation of the stage of evolution once passed through by our ancestors. Their signs, as well as their myths and customs, form a part of the paleontology of humanity. Their picture writings are now translated by working on the hypothesis that their rude form of graphic representation, when at the same time a system of idiographic gesture signs prevailed, would probably have been connected with the latter; traces of the signs now used by the Indians are also found in the idiographic pictures of the Egyptian, Chinese and Aztec characters.

From the records of the ancient classic authors and also from the figures on Etruscan vases and Herculanean bronzes and other forms of Archaic art, it is certain that a system of gesture language is of great antiquity. Later Quintilian gave elaborate rules for gesture which are specially notable for the significant disposition of the fingers still prevailing in Naples. The ancient and modern pantomimes were discussed, and also the gestures of speaking actors in the theaters, the latter being seldom actually significant or self-interpreting even in the expression of strong emotion. The same scenic gesture must apply to many diverse conditions of fact. Its fitness consists in being the same which the hearer of the expository words would spontaneously assume if yielding to the same emotions, and which, therefore, by association tends to induce sympathetic yielding. But the facts themselves depend upon the words uttered. A true sign language would express the exact circumstances without any exhibition of the general emotion appropriate to them.

This was shown to be in successful use in cases cited by travelers skilled in it, and its powers were compared with those of speech. It finds actually in nature an image by which any person can express his thoughts and wishes on the most needful subjects to any other person. Merely emotional sounds may correspond with merely emotional gestures, but whether with or without them would be useless for the explicit communication of facts and opinions by which signs themselves are capable. Notwithstanding frequent denials, they do possess abstract ideas. The rapidity of communication is very great, and can approach to that of thought. Oral speech is not conventional, and with the similar development of sign language conventional expressions could be made with hands and body more quickly than with the vocal organs, because more organs could be worked at once.

But such rapidity is only obtained by a system of preconcerted abbreviations and by the adoption of absolute forms, thus sacrificing self-interpretation and naturalness.

Signs often gave to spoken words their first significance, and many primordial roots of language are found in bodily actions. Examples are given of English, Indian Greek and Latin words in connection with gesture signs for the same meaning, and the structure of the sign-language was compared with the tongues of this continent, with reference also to old Asiatic and African languages, showing similar operations of conditions in the same psychologic horizon.

It is necessary to be free from the vague popular impression that some oral language of the general character of that now used by man is "natural" to man. There is no more necessary connection between ideas and sounds, the mere signs of words that strike the ear, than there is between the same ideas and signs for them which are addressed only to the eye. Early concepts of thought were of direct and material characters. As is shown by what has been ascertained of the radicals of language, and there does not seem to be any difficulty in expressing by gesture all that could have been expressed by those radicals.

It may be conceded that after man had all his present faculties he did not choose between the adoption of voice and gesture, and never with those faculties was in a state where the one was used to the absolute exclusion of the other. The epoch, however, to which our speculations relate is that in which he had not reached his present symmetric development of his intellect, and of his bodily organs, and the inquiry is: Which mode of communication was earliest adopted to his single wants and informed intelligence? With the voice he could imitate distinctively but few sounds of nature, while with gesture he could exhibit actions, motions, positions, forms, dimensions, directions and distances, with their derivations and analogies. It would seem from this unequal division of capacity that oral speech remained rudimentary long after gesture had become an efficient mode of communication. With due allowance for all purely imitative sounds, and for the spontaneous action of vocal organs under excitement, it appears that the connection between ideas and words is only to be explained by a compact between speaker and hearer which supposes the existence of a prior mode of communication. This was probably by gesture. At least we may accept it as a clew leading out of the labyrinth of philological confusion, and regulating the immemorial quest of man's primitive speech.

In the evening session Captain C. R. Dutton read a paper on the Grand Cañon of the Colorado River, of which the following brief abstract is given:

A picture was exhibited of a portion of the chasm about the middle of its length, which was typical of its features throughout a great portion of its extent. It consists of an inner and an outer chasm. The outer chasm is about five or six miles wide, with a row of palisades two thousand feet high on either side, and a broad and comparatively smooth plain between. Within this plain is cut the inner gorge, descending more than three thousand feet lower, and with a width of about three thousand five hundred feet. The upper palisades are of very noble form and uniform profiles, with a highly architectural aspect. Pictures were also exhibited of the chasm as seen from below.

The speaker then conducted his hearers to the region lying north of the chasm. The region through which it extends consists of carboniferous strata, but about forty miles north of the river appear strata of later age, forming a series of terraces, each terrace being terminated by a line of gigantic cliffs, one thousand to two thousand feet high, and of very wonderful sculpture and brilliant color; the strata in this stairway of terraces are the remnants of beds which are stretched unbroken over the entire district now drained by the Grand Cañon. The total thickness of the beds removed was more than ten thousand feet, and the divided area more than thirteen thousand square miles. This denudation began in the Eocene time, and has been continuous until the present. A great amount of uplifting has also occurred during the same period, varying according to locality from sixteen thousand to nineteen thousand feet, and the present altitude of the region is the difference between the amount of uplift and the thickness of strata removed—*i. e.*, seven thousand to nine thousand feet. The cutting of the Grand Cañon is thus merely the closing episode of a long period of erosion. Captain Dutton states that the cutting of the present chasm is a comparatively recent geological event, and probably had its beginning in the Pliocene time.

The process of excavating the cañon was then briefly explained. It consists in the action of two classes of natural causes. The first is the scouring action of the stream upon the rocks in its bed. The stream is a fierce torrent, carrying large quantities of sharp sand, which acts like a sand-blast. A river will always cut down its bed when the quantity of sediment it carries is less than it is capable of carrying. When this quantity is greater a part of it is thrown down upon its bottom, protecting it from scouring. In this respect the Colorado is an exceptional river. The other process is weathering. The stream cuts a chasm no wider than its water-surface. But the cut thus made is widened by the secular decay of the walls of the chasm which, though slow to the perception becomes great after the lapse of many thousands of years. The peculiar architectural profiles were explained as being due to different degrees of resistance afforded by different beds to the action of weathering. Captain Dutton then exhibited views of the grandest portions of the chasm. Although the magnitudes of the component parts are very great, the highest sublimity is found in the sumptuous and noble rock temples and beautiful sculpture of the walls, which show almost incredible resemblances to human architecture. The colors also are very brilliant and rich.

The Grand Cañon is about two hundred and twenty miles long, from five to twelve miles wide, and from five thousand to six thousand feet deep. Those who have seen it all unite in declaring it to be the most sublime and impressive of all natural features in the world.

The first paper on the programme, in section A for the second day, was that of J. E. Hilgard, "On recent deep-sea soundings in the Gulf of Mexico and Caribbean Sea, by the United States Coast Survey," which, in the absence of its author, was read by Dr. W. H. Dall. The paper was well prepared and instruct-

ive, and showed among other interesting facts, that the Gulf is not a shallow continental sea, like the Irish Sea for instance, but is a true oceanic body, of as great depths as the Atlantic.

R. H. Thurston's paper "On the Effect of Prolonged Stress upon the Strain in Timber" was read by the Secretary, Professor Tappan, of Kenyon College, and was freely but not unfavorably discussed.

"A remarkable case of the retention of heat by the earth," by H. C. Hovey, treats of a bed of ashes buried thirty feet deep, in Nova Scotia, on the top of a bed of bituminous coal, over which trees showing an age of over two hundred and twenty-five years were growing. These ashes show that they still retained a very appreciable portion of the heat of the fires that must have been kindled from two to three hundred years ago.

"Alhazen's Problem; its history and bibliography, together with various solutions of it," by Marcus Baker, was a paper of ability, but of more interest to the lovers of pure mathematics than to the practical public.

"On the Electrical Resistance and Co-efficient of Expansion and Incandescent Platinum," by E. L. Nichols.

"On a Simple Method of Measuring Faint Spectra," by Wm. Harkness.

The two following papers were the last on the programme for the day, in Sec tion A proper: "Suggestions for Improvement in the Manufacture of Glass and New Methods for the Construction of Large Telescopic Lenses," by G. W Holley.

"The Stereoscope and Vision by Optic Divergence," by W. Le Cont Stevens.

Several papers on the programme of Section A were omitted, the author being absent. In the subsection of Microscopy, Mr. Thomas Taylor read paper entitled "New Freezing Microtome." In Section B the following paper were read:

"A Revision of the Anatomy of the Ethmoid Bone in the Mammalia," b Harrison Allen. "On Bopyrus Manhattensis from the Gill-cavity of Palæmo etes Vulgaris Stimpson," by Carl F. Gissler. "The Life Unit in Plants," b Byron D. Halsted.

The paper "On a Mesal Cusp of the Deciduous Mandibular Canine of th Domestic Cat, Felis domestica," by Burt G. Wilder, was read by Professor Tu tle, of Columbus, Ohio, and "Note on Some Fish Remains from the Upp Devonian of New York," by H. S. Williams; "Notes on Specimens of Ptiloph ton and Associated Fossils Collected by Dr. H. S. Williams in the Chemu Shales of Ithaca, N. Y.," by J. W. Dawson, were read by Professor H. S. W liams, of Cornell University, New York, the author of the first one.

"Typical Thin Sections of the Rocks of the Cupriferous Series in Minnes ta," by N. H. Winchell, was read by its author.

"On the Disposition of Color-markings of Domestic Animals," by Wm. I Brewer, was read by its writer in an animated tone of voice that could be hear which can not be said of all others.

"Short Study of the Features of the Region of Lower Great Lakes, during the Great River Age; or Notes on the Origin of the Great Lakes of North America," by J. W. Spencer, was the longest paper of the day, though it was listened to with great interest all through, and was considerably discussed.

"On the Cause of the Arid Climate of the Far West," by Captain C. E. Dutton.

Lieutenant-Governor Wm. Bross, of Illinois, read a paper entitled "Cañons as I Have Seen Them, with Some Thoughts as to their Origin."

The first paper in Section D, sub-division of Anthropology, was read by Professor O. T. Mason, "On Uncivilized Mind in the Presence of Higher Phases of Civilization," a most interesting document. Its author has been engaged during the past year in collecting the statistics of Indian education from the earliest efforts in that direction to the present time, under the patronage of Major J. W. Powell, Chief of the Indian Division of the Tenth Census. During his investigation Professor Mason was led to consider the philosophic side of the subject and his results, so far as ascertained, are embodied in this paper on the effect of higher on lower civilizations.

"A Lawgiver of the Stone Age," by Horatio Hale, was read by Mrs. Smith, of the Bureau of Ethnology, Washington, D. C.

"Mound-builders' Skeletons," by Watson C. Holbrook, was next read. Though a short paper it was an excellent one, closely listened to.

The next paper was entitled "The Stone Images and Idols of the Mound-builders," by William McAdams, who had present as a sort of text and illustration either the casts or the originals of many most valuable and rare specimens of sculptured images, pipes, etc., largely owned by Dr. Snyder, of Illinois. Mr. McAdams is himself an indefatigable collector and worker in the field of pre-historic American remains.

Among all the relics of the Stone Age, nothing is of more interest to the student of ethnology, than the sculptured forms of men and animals found on some of the objects taken from the mounds.

Mr. McAdams divides these sculptured objects into four classes, representing, it may be, four periods of advancement:

1. The mound pipes with a curved or crescent-shaped base forming the stem, the bowl of the pipe representing some animal. These pipes are not made of very hard stone, as has been generally supposed. They are quite small and delicate, many of them showing both taste and skill in manufacture.

2. This class is a much larger, and sometimes exaggerated, representation of men and animals, many of them having a crouching, Sphinx-like form strongly resembling some of the ancient Assyrian forms from the Nile. While some of these figures have no perforation, the majority of them have two funnel-shaped connected perforations, and they are in all probability used as a pipe on occasions of great ceremony. Some of these images, from mounds in Illinois, and weighing ten to twenty pounds or more, are sculptured from hard stone, and are among the finest works of the Stone Age.

3. Is a class of singular mask-like figures, in which the human face alone is represented, presumably of the natural size. A very fine specimen of a hematite from a mound in Missouri was exhibited.

The fourth class of the sculptured objects were representations of the human form, and may have been real idols. One of them, from a mound in Union county, Illinois, is cut from quartzite, one of the most refractory rocks we have. The body is represented in the sitting posture, the hands on the knees. The face, which is not a bad one, is composed and natural, but has not the features of our modern Indian. The figure is smooth and highly polished, and is, perhaps, the finest piece of aboriginal sculpture that has been found in the United States.

Mr. McAdams thinks these objects exhibited by him were connected, or used, in their religious observance. The speaker thought the evidence from the mounds would seem to show that the Mound-builders were fire-worshipers, and perhaps adored the sun. Sometimes at the burial of noted persons, human sacrifice was made. In exploring some of the large mounds of Illinois he has found as many as ten and fifteen buried human sacrifices around a central skeleton, with rich implements of stone.

Mr. McAdams' most interesting paper was illustrated by a large number of images and idols which he described, and which he has taken from the mounds of Illinois and Missouri. It has heretofore been held by some of our best archæologists that it were doubtful if we had any American idols, but it is claimed by others that we not only have stone idols from the latter mounds, but that, as is claimed by Mr. McAdams, human sacrifice in the most hideous form was made to the stone objects. One of the idols shown, found in Union county, Illinois, weighs over forty pounds, and is carved from that most refractory of rocks, quartz, and as a work of art is no mean effort. It is singular that this figure which has a good face, does not resemble that of our red Indian. We are glad to see these subjects, which have for so many years been covered by so much mystery, being investigated by our scientific men. The Mississippi Valley is a grand field for explorations. The beautiful mound pipes shown by Mr. McAdams, one of which is a fine figure of the American eagle, with his defiant and erect attitude is very artistic, and shows, too, that Illinois had the same race of Mound-builder as Ohio. In fact they are found everywhere, as Mr. McAdams pointedly remarked: "It is most singular that all primitive men, no matter where their remains are found, seem to have done precisely the same things, in the same way."

J. G. Henderson, of Illinois, read a paper on the "Houses of the Ancient Inhabitants of the Mississippi Valley."

Papers were also read: "On the Inhabitants of Northeastern Siberia, commonly called Chukchis and Namollo," W. H. Dall.

"Comparative Differences in the Iroquois Group of Dialects," Mrs. Erminnie A. Smith.

"On the Ancient Japanese Bronze Bells," Edward S. Morse.

In Section F, permanent sub-section on Entomology, the following papers were read: "On Certain Habits of Heliconia Charitonia," W. H. Edwards.

"Life-History of the Buckeye Stem-borer. *Sericoris intstrutana* Clem," E. W Claypole.

"New Insects Injurious to American Agriculture," C. V. Riley.

"The Egg-case of Hydrophilus triangularis," C. V. Riley.

"On the Oviposition of Prodoxus decipiens," C. V. Riley.

"The Cocoon of Gyrinus," C. V. Riley.

The geologists of America attending the Association, held a meeting and resolved to form an "Association of American Geologists."

The third day's session of the Association commenced with some general business in reference to raising $4,000 for the purpose of publishing certain numbers of the Transactions now out of print. Subscription papers were circulated and an additional $110 was quickly raised.

Professor Swallow made a statement in reference to the formation of an American Geological Society. The movement was not hostile to the American Association, as they did not intend to withdraw themselves from that Society. In the readjustment of sections they wished to consult about their relation to the Association and their wants. They desired to form a geological library as it is almost impossible for a private library to gather the publications now issued from a hundred sources. One can scarcely describe a new fossil now for fear some one has already described it. After electing a large number of new members, the Association received a report from the standing committee upon the subject of conferring the degree of Doctor of Philosophy. The report concurred with the American Philological Association in deprecating the custom of many colleges in conferring the degree, not by examination, but *honoris causa*. The report was thoroughly discussed and unanimously adopted. There are three hundred and sixty institutions of collegiate grade in the United States, and the conferring of the higher degree, *honoris causa*, has worked much harm against sound learning. If a scientist wants a Ph. D. let him study for it.

After receiving invitations from Minneapolis and Toronto for holding the next meeting of the Association, the regular order of business was taken up for the reading and discussion of papers.

The first paper, in Section A or Physics, upon the programme was upon the subject of the "Magnetic Survey of Missouri," by Francis E. Nipher, but owing to the necessary absence of that gentleman it was read by Professor Mendenhall. It was a brief discussion of results of his experiments to ascertain the dip of the magnetic needle in the State of Missouri, and the influence of the Iron Mountain and other natural causes upon the compass.

D. P. Todd was absent, and his paper upon the "Comparison of Newcomb's Tables of Uranus and Neptune with those of the same Planets by Le Verrier," was not read.

One of the best talks of the day in this section was Professor Wm. Harkness' address "On the Methods of Determining the Solar Parallax, with Special Refer-

ence to the Coming Transit of Venus," which was received with enthusiastic applause. He divided the methods for finding the sun's parallax into three classes, the trigonometrical, the gravitational, and the third, the name of which he coined for the occasion, the pho-tachymetrical. The latter is the best, and consists in a process by means of the use of the measurements of the velocity of light. This method, the most modern, was fully explained and illustrated by blackboard drawings.

Professor T. C. Mendenhall opened the afternoon session by reading an elaborate and quite interesting paper "On the Wave-lengths of the Principal Lines of the Solar Spectrum." It consisted of a brief discussion of the processes and instruments made use of in the measurement of wave-lengths, of certain imperfections, in the defraction, grating and causes to which they are due, and the numerical results of the investigation. He showed that the inequalities observed in solar spectra were due to the variations in the plane of polarization, and concluded with a prophecy that in the future the use of the wave-length of light as the standard of linear measure would be as universal as the use of water as the standard of density.

Samuel Marsden, of St. Louis, read a description of his experiments to determine the comparative strength of globes and cylinders of the same diameter and thickness. He exhibited some lead globes and cylinders four inches in internal diameter and one-fourth of an inch in thickness, which he had used in his experiments with a hydraulic testing machine. The theoretical strength of the cylinder is proportional to the diameter and tensile strength of its sides. Calculating this, and comparing it with the results of the actual strength, as determined by his experiments, it was found that in but one case out of eight was the result identical. This he ascribed, not to the imperfection of his experiments, but to the failure of the rule.

Mr. T. Sterry Hunt then explained his peculiar views upon the nature of interstellar ether by an address on "Historic Notes on Cosmic Physiology."

"The White Pine: Its Origin and Natural History; Statistics of Its Industry in Michigan; The Coming Substitute for Lumber," by William Hosea Ballou, of Evanston, Ill. This paper possesses much general and commercial, as well as scientific value. The author showed that at the present rate of demand the white pine supply will be exhausted in about seven years.

Science will doubtless devise other materials as a substitute. Indeed, I have been shown a material manufactured in Chicago in the shape of a board one inch thick, made from wheat straw, which can be colored to represent any lumber now known, so accurately as to deceive the eye. The inventor manufactures two thousand square feet from a ton of straw. It is more durable and much cheaper than lumber. As a parallel to the use of paper wheels, Mr. Pullman is now finishing off three palace cars in this material. The limit of its manufacture will depend only on the production of wheat straw.

The proceedings of Section C, Chemistry, were opened by a discussion of the paper presented yesterday by Mr. H. C. Hovey, on "Coal Dust as an Ele-

ment of Danger in Mining." At the request of the chairman the author of the paper gave a brief recapitulation of its principal points, and claimed it to be proved by the circumstances of the Albion Mines explosion:

1. That coal-dust, under favorable conditions, becomes the vehicle of flame.
2. That it thus spreads and augments gas explosions.
3. That it may determine and precipitate explosions due to the presence of inflammable gas in otherwise harmless and scarcely appreciable quantities. The subject was further discussed by others, most of the time being occupied by Professor Peckham, who regarded coal-dust, when finely pulverized, as an explosive substance, and not merely a vehicle of flame. In proof of this he gave some highly interesting facts concerning explosions of flour-dust in the mills of Minneapolis. He held that the matter was one of the greatest practical importance to miners and millers.

The following papers were read:

"On Iso-picraminic Acid," Charles W. Dabney, Jr.

"Composition and Quality of American Wines," Henry B. Parsons.

"On Chlortribrompropionic Acid," C. F. Mabery and H. C. Weber.

"Is the Law of Repetition the Dynamic Law Underlying the Science of Chemistry?" Miss Virginia K. Bowers.

"The Limited Biological Importance of Synthetic Achievements in Organic Chemistry," Albert B. Prescott.

"The Constitution of the 'Atom' of Science," Mrs. A. B. Blackwell.

"On Dibromiodacrylic and Chlorbromiodacrylic Acids," C. F. Mabery and Rachel Lloyd.

"Pentachloramyl Formate," Alfred Springer.

"Evidence of Atomic Motion Within Molecules in Liquids as Based Upon the Speed of Chemical Action," R. B. Warder.

Prof. J. Lawrence Smith read two papers on the following subjects: "Iron with Anomalous Chemical Properties," and "Hiddenite, a New American Gem."

Prof. G. C. Swallow, of Missouri, read an able paper on "Ozark Highlands," after which came a paper by Professor Edward S. Morse. In this paper Mr. Morse showed that considerable change had taken place between the species of shells forming the ancient deposits of shells made by the Indians along the coast of New England and the same species living on the coast to-day.

By measuring a large number of specimens from the deposits and a similar number of specimens of the same species living to-day, he had found the proportions of the shells constantly unlike. As an example he cited the common clam (*mya*), the species as it occurs in the shell-heaps being higher in proportion to its length than the same species living to-day. He had already called attention to similar changes in the shell-heaps of the Bay of Yedo, Japan.

Dr. H. D. Schmidt's paper "On the Influence of the Structure of the Nerve-fibers upon the production and conduction of Nerve-force," was a long one—so long that the Chairman felt obliged to prevent its full reading, it having already

consumed more than its allotted time—forty-five minutes. It showed care in its preparation.

The next was the able paper, "The Berea Grit of Ohio," by President Edward Orton, which was listened to with great attention, as it deserved.

In the section of Entomology Professor W. H. Edwards, pronounced by good authority to be the ablest and most learned man on the subject of butterflies, read an able paper "On the Length of Life of Butterflies," after which two papers, also excellent and able, "On the Duration of the Heterocera (Moths)," and "A Remarkable Invasion of Northern New York by a Pyralid Insect (*Crambus vulgivagellus*)," were read by J. A. Lintner.

Professor Edwards then read another paper "On an Alleged Abnormal Peculiarity in the History of Argynnis Myrina."

J. A. Cook read three papers, entitled as follows: "How Does the Bee Extend Its Tongue," "The Syrian Bees," "Carbolic Acid as a Preventive of Insect Ravages."

The last paper read was upon the "Life-History of the Buckeye Stem-Borer," by Professor E. W. Claypole.

The first paper in the Anthropological section was read by Professor W. J. Hoffman, of Washington, upon the "Interpretation of Pictographs by the Application of Gesture Signs." The paper was illustrated by a large number of Indian pictographs, and, to be thoroughly understood, should be considered in connection with the address of the chairman of this section, upon "Gesture Language." The speaker showed that in many instances the native artist attempted to convey ideas by presenting to the eye, as near as the nature of the subject would permit, representations of the gestures used to represent the same idea in sign language. The paper was highly instructive, and no synopsis can do it justice for want of illustrations.

"Remarkable Relics from Illinois Mounds." This was a short talk by Mr. McAdams, illustrated by numerous specimens taken from Illinois mounds with his own hands. He is a zealous worker in a field where work counts—that is, he shoulders his spade and pick and explores for himself the antiquities in his neighborhood, and reports his finds accurately to the Association. His remarks are always listened to with pleasure.

The next paper was by Professor Edward S. Morse, "On the Ancient Japanese Bronze Bells." The subject was curious, and was admirably illustrated by sketches upon the blackboard. In this department, that of off hand drawing upon the board or canvas, Professor Morse is without an equal in the Association.

Following this paper was one by Mrs. Erminie Smith, the charming lady anthropologist of the Association. It was upon "The Animal Myths of the Iroquois." She gave several illustrations of the oral literature of that unlettered race—a literature that is fast fading from the face of the earth! These oral tales were reduced to writing by Mrs. Smith as she received them from the lips of aged Indians. She is proud of the fact that she is an adopted Tuscarora, and waves

the flag of *her* people in friendly triumph over the heads of her brother anthropologists.

The next paper was by Judge Henderson upon the question as to whether the antelope ever ranged over the prairies of Illinois. The speaker said that he read a paper in February last, before the Natural History Society of Illinois, on the "Ancient Inhabitants of Illinois," in which he enumerated the antelope as one of the animals hunted by the primitive people upon the great prairies of that State. From the fact that Judge Caton had failed in attempting to domesticate this animal in Illinois, some of the members of that Society raised a question as to whether it ever was a part of the *fauna* of that locality. In a letter from Judge Caton to the speaker, the writer stated that he attached no importance to the failure in attempting to domesticate this animal, as similar attempts within the present range of the antelope proved more abortive than those made by him. Judge Henderson then proceeded to give extracts from old French authors, some of which were written more than two hundred years ago, in which two distinct animals of the deer family were mentioned, the cerf, or deer proper, and chevreuil, or the antelope.

The Secretary read two papers by Mr. Watson C. Holbrook, of Illinois, one on "Prehistoric Hieroglyphics," and the other upon "Stone Implements in the Drift," after which Mr. S. H. Trowbridge, from Missouri, exhibited some remarkable archæological specimens found in this State.

At the opening of the general session of the Association, the fourth day, Professor Rogers of Boston, the first president, was elected to the honorary fellowship of the Association, the first one to receive that title.

Professor Mendenhall, of Columbus, by permission rose to state that the Seismological Society of Japan, was making valuable contributions to science on the subject of earthquakes. Japan has facilities for observing the phenomena attending terrestrial disturbances that are equaled by no other country. Earthquakes occur on an average once in two weeks, and this Society, though poor and contending with many difficulties, is doing a noble and important work—a work which can be done by no other society in the world.

The Association resolved to hold its next meeting at Montreal, and a warm and pressing invitation to hold the meeting in 1883 in Minneapolis, was referred to the standing committee.

The authors of papers No. 1 and No. 2 being absent, they were read by title only. The first was "Upon the Use of the Induction Balance as a means of Determining the Location of Leaden Bullets in the Human Body," by Professor Alexander Graham Bell. It gave an account of the experiments made to locate the bullet in the body of President Garfield by means of the induction balance.

The second was also by Professor Bell. It was "Upon a New Form of Electric Probe," and gave an account of the experiments which have led to the discovery that the presence of a bullet imbedded in the human body in any suspected locality can be demonstrated by the insertion through the skin of a fine needle electrically connected with the telephone.

Professor H. T. Eddy, of the Cincinnati University, then read his paper "On a New Method of Applying Water-power of Small Head to Effect the Direct Compression of Air to any Required High Pressure."

Dr. J. Lawrence Smith followed with an explanation of "The Needle Telephone," a new instrument invented by Dr. Goodman, of Louisville, Ky. The invention made use of needles arranged between two coils and a tightly-stretched diaphragm, instead of the usual coils and loose diaphragm used in the Bell and other telephones. It was stated that the Needle Telephone is really much better than any other telephone, but on account of existing patents could not be used at present. He hoped, however, that a "transmitter" would yet be invented upon some principle not falling under present patents, which, combined with Dr. Goodman's invention, could yet be utilized.

The paper occasioned remarks by Dr. Smith, and others upon the present condition of the American patent laws, and the sentiment was universally expressed that there is urgent need for reform.

Professor W. LaConte Stevens read a paper on an "Improved Sonometer."

Section A reassembled in the afternoon, and the session was opened with a paper by Prof. Ormond Stone, on "The Great Outburst Comet *b*, 1881, observed at the Cincinnati Observatory." Mr. Wilson, Prof. Stone's assistant, being present was called upon and stated that while looking through the telescope on the evening in question he noticed a peculiar and unnatural brightness in the comet. He at first supposed that the telescope was not properly focused, but, after adjusting the focus by a fixed star, he found on re-examining the comet the same unnatural glare on the side toward the tail, and observed a black line extending across the comet.

Professor Stone continued: He having been called by Mr. Wilson, hastened to examine the comet. He noticed the same peculiarities described by Mr. Wilson. The color was red to the hue of the fan.

The next paper was that of Prof. J. R. Eastman, of Washington, on the "Method of Determining the Value of the Solar Parallax from Meridian Observations of Mars." This was described as the most trustworthy of all methods for determining the solar parallax. It consists, in general, of observing at two different times, say at night and the following day, eight fixed stars, four north and four south, of the observer. By comparing these observations and observations taken of the planet Mars at the same times, the error occasioned by diffraction is corrected.

Professor H. A. Newton, of Yale College, then read a paper on "Numbers of Cometary Orbits Relative to Perihelion Distance." After discussing several hypotheses, the Professor showed mathematically that the orbits of comets are really parabolas, and they belong in some sense to the system of the earth.

Professor Peirce, of Johns Hopkins University, read a paper "On the Comparison of the Yard and Meter by Means of the Reversible Pendulum."

Thomas Bassnett, of Jacksonville, Florida, read a lengthy paper ascribing meteorological disturbances to the effect of "Seven Electrical Vortices."

D. W. Prentiss, in Section B, read an interesting paper entitled, "On the Action of Pilocarpin in Changing the Color of Human Hair," which was of great interest.

Dr. George Sutton, of Aurora, Indiana, read a paper entitled, "The Gold-bearing Drift of Indiana." It gave in detail and in technical language the supposed glacial history of that State, and the different directions and paths followed by the different glaciers.

The paper showed that there is a line of gold-bearing drift extending across the State from Southeastern Indiana in a west and northwest direction to Illinois; and that the drift along this line is comparatively rich in gold, while the gold that is found in other parts of the State is in such small quantities that it is with difficulty that it can be detected.

There is a vast extent of country on the northern portion of our continent from which glaciers moved, and a large extent of country which has never yet been carefully examined, and I think we are not visionary in saying that we believe it is probable that rich gold veins may yet be discovered beyond the lakes which will give rise to all the excitement incident to the discovery of new gold fields, and the miner, the capitalist, the speculator, the emigrant and the adventurer may hurry to a region of country which is now but a barren wilderness, and villages, cities and railroads spring into existence as if by magic, and scenes be enacted in the North similar to that we have so recently witnessed in the West.

Professor Richard Owen read a paper on "The Unification of Geological Nomenclature." A geological nomenclature has grown up in every country, and almost in every State, and the paper advocated a uniform system. The geologist at present is burdened with many names arising in different countries which indicate the same things.

The last paper read in this Section was: "Recent Discoveries, Measurements and Temperature Observations made in Mammoth Cave," by Rev. H. C. Hovey. The speaker placed before the section a map illustrating the cave, and showed the difficulties of constructing such a map, the chief of which was the unwillingness of the proprietors of the cave to have a correct survey published.

Mr. Hovey stated that the saltpeter derived from Mammoth Cave, was conveyed to Philadelphia by mules and in ox-carts, and was the chief source of material for gunpowder used in the war of 1812. This fact has not been stated in a single history of the United States. The author of the paper laid before the section, who extended his time, the results of temperature observations made in 1878 and corrected this month. Sixty temperature observations were taken, of half an hour each, the instruments used being the Casella and Green thermometers from the Winchester Observatory. The results obtained are: The lowest temperature in any part of the cave is 52° F.; the highest, 56° F.; the general temperature of the cave may be fixed at 53° F., which would, of course, be also the temperature of the crust of the earth in the region where the cave is located.

Professor Cox, the Vice-President of the section, congratulated Mr. Hovey, on settling this important point, which had long been in dispute among scientific men. After some remarks in reference to priority of discovery of Welcome avenue leading from Blacksnake avenue into Serpent Hall, the section adjourned.

In the section of Anthropology, the first paper read was "Worked Shells in the New England Shell Heaps," by Edward S. Morse. Mr. Morse exhibited specimens of the large winch cockle (*lunatia*), which showed unmistakable signs of having been worked. His work consisted in cutting out a portion of the outer whorl near the surface. To show that this portion could not be artificially broken he exhibited naturally-broken shells of the same species, both recent and ancient, in which the fractures were entirely unlike the worked shells.

Professor Cyrus Thomas read a paper entitled, "Comparison of Maya Dates with Those of the Christian Era."

Professor Thomas is preparing for the Bureau of Ethnology of the Smithsonian Institution an article on "The Manuscript Troano," which is described as follows:

This manuscript was found about the year 1865 at Madrid, Spain, by the Abbe Brasseur de Bourbourg while on a visit to the Library of the Royal Historical Academy, and named by him "Manuscript Troano," in honor of its possessor, Don Juan de Tro y Ortolano.

This work was reproduced in fac-simile by a chromo-lithographic process by the commission Scientifique du Mexique, under the auspices of the French Government, Brasseur de Bourbourg being the editor.

The original is written on a strip of Maguey paper about fourteen feet long and nine inches wide, the surface of which is covered with a white paint or varnish, on which the characters and figures are painted in black, red, blue and brown. It is folded fan-like into thirty-five folds, presenting, when the folds are pressed together, the appearance of an ordinary octavo volume. The hieroglyphics and figures cover both sides of the paper, comprising seventy pages, the writing and painting of the figures having been apparently executed after the paper was folded, so that the folding does not interfere with the writing.

Some progress has been made in deciphering the Maya picture-writing or hieroglyphics.

Mr. McAdams read a paper on "Stone Implements from the Drift," and exhibited several stone axes which some persons thought showed drift marks upon them. They were found in ravines, and might be referred to a period much older than that to which they really belonged. In his explorations he had found nothing which convinced him that we really have paleolithic implements in our drift deposits. The relics were examined with great interest.

In the Section of Entomology, Professor Riley read a paper on "The Egg-case of Hydrophilus triangularis," with illustrative drawings; also another on "The Oviposition of Prodoxus decipiens," a small white moth.

B. Pickman Mann read a paper on "Suggestions of Co-operation in Furthering the Study of Entomology," and Psyche in particular.

The Cincinnati meeting of the American Association for the Advancement of Science, really the American Congress of Science, was a most important one, whether we view it in reference to the numbers in attendance, the high standing of the members in their various specialties, or the bearing upon science and real life, of the subjects discussed. Considerable space has been devoted by the REVIEW to the Proceedings of this meeting, still we have found it possible to give but the barest synopsis, much important matter having necessarily been omitted. After the adjournment the members took their accustomed excursion which afforded the rest and recreation so much needed after severe professional duties.

CHEMISTRY.

GLASS AND CEMENTS.

From the proceedings of the Polytechnic Club of the American Institute, March 24th, we clip the following paper upon "Glass and Cements," by Dr. John Phin, of the *American Journal of Microscopy*, which will be of very general interest to a large proportion of our readers:

Cements are to be divided into four classes according as they dry, congeal by oxidation, harden by cooling, or "set" by other chemical changes. First are those which harden by evaporation. Under this head may be classed paste, mucilage and their varieties. Glues to a certain extent dry.

The second class includes the oils. These are said to dry, but it is not by evaporation. They lose nothing, but absorb oxygen from the air. The cement weighs more after hardening than when first applied. Cements which congeal by oxidization cannot be treated in the same way as those of the first class. They require a larger time to handle. The hardening goes on from the outside inward. For example, mend a piece of porcelain with one of these cements. Test it in a few days, and although the outside will be hard, the inside will not appear to have dried in the least, and will have no tenacity. Leave it for six months, and it will be very strong.

Thirdly, we have those cements which harden by cooling. These, instead of gaining their strength slowly, like those of class two, become hard at once. Shellac is a good example of a cement of this kind. China put together with melted shellac is extremely strong.

A fourth class of cements may be represented by plaster of Paris. This is the type of an extensive class, including the whole line of mortars and hydraulic cements, on which depend our great engineering works, and even the houses in which we live. It forms a chemical compound combination with water first, and then more slowly hardens by drying, a part of the water evaporating.

In order to use a cement successfully we must know to what class it belongs and treat it accordingly. Next, we must know how to put it on. In no case should it be used in a large quantity. The less the better is a good rule to follow.

In mortar we mingle sand, which makes the actual thickness of the lime between the stony surfaces in all cases very slight, however much mortar we may employ. In the use of glue this is not practiced or necessary. The joints made by carpenters are good examples of the minute quantity of a cement which is necessary. Place a well-made glued joint on the edge, and it is almost impossible to find the lines of glue. Its position is mainly discovered by the direction of the grain of the wood.

Intimate contact between the cement and edges is necessary. This is not easy, on account of the layer of air which adheres to all bodies. This layer of air is what causes needles to float when carefully placed upon the surface of water. When an object is warmed the film of air is easily moved, the hot needle sinks, and to the hot body the cement will adhere easily. It is faulty for this reason, that in gluing it is needful to have the work warmed. The rubbing of the surfaces together gets rid of the air, and then not only with glue, but with all cements, the surfaces must be pressed closely together.

Common glue has most enormous strength and adhesive powers if it is good. But to be good it must not have been injured in the making by decomposition, to which the material and the glue itself are peculiarly subject. Here the lecturer detailed at some length the process of glue-making, and said that if glue was not pleasant to both taste and smell, it would not be strong. If not offensive, it could be trusted to hold wood more strongly than its own fibers.

The strongest known glue is that made from the skins and sounds of fishes, and the strongest of this class is made in Lapland, from the skin of a perch. The Laplanders use it in making their bows, which are both strong and durable. In making it their cold climate is greatly in their favor; here a fish skin will begin to undergo decomposition before it can be dried.

In making it the skins are put into a bladder, which answers for a water bath, and heated in water until a sort of glue results. This glue is, as may be imagined, very elastic. Isinglass is a very strong glue, made from skins, sounds, etc., of fishes; it is very liable to be spoiled in making by overheating.

BOOK NOTICES.

THE STATE AND HIGHER EDUCATION. An address before the Minnesota Academy of Natural Sciences, by Prof. N. H. Winchell.

The address takes the ground that the State "should not only take measures to qualify her citizens to read their ballots, but to discharge all the duties of high citizenship."

FIRST ANNUAL REPORT OF THE WINCHESTER OBSERVATORY. By the astronomer in charge of the Horological and Thermometrical Bureaus, 1880–81.

This Bureau possesses the most approved instruments known to modern science, including a fine transit, for correcting chronometers, clocks, watches and thermometers. Hitherto this work has been largely done abroad, instruments being sent to Kew, and elsewhere, but the authority of the Winchester Observatory has recently been accepted as final. Fifty thermometers of physicians, taken from actual practice, have been examined during the past year, whose errors exceeded a degree and a half. The report states that "there have been, comparatively, but few physicians' thermometers made in this country which have united accurate graduation of the scale with the requisite age of tube, necessary to preclude further sensible changes, and there is little doubt that the great majority of physicians' thermometers now in use in the United States are from one-half to two degrees high in their indications.

PAPERS OF THE ARCHÆOLOGICAL INSTITUTE OF AMERICA. (American Series.) By A. F. Brandelier.

This volume contains two papers: 1. Historical Introduction to Studies among the Sedentary Indians of New Mexico. 2. Report on the Ruins of the Pueblo or Pecos.

THE 12TH AND 13TH ANNUAL REPORTS OF THE PEABODY MUSEUM OF AMERICAN ARCHÆOLOGY AND ETHNOLOGY, at Cambridge, Mass., are now in press.

These volumes will contain several valuable essays on subjects connected with American Archæology. Of these essays the one by Mr. Schumacher on "The Method of Making Pottery and Baskets by the Indians of Southern California," and another by Hon. Lewis H. Morgan, "Description of an Ancient Stone Pueblo on the Animas River, New Mexico," will be of special interest to those engaged in the study of the beginnings of the arts among the aborigines of America.

ARTISTS OF THE NINETEENTH CENTURY AND THEIR WORKS. By Clara Erskine Clement and Laurence Hutton, is a hand-book of biographical sketches of American and European artists of the present century, numbering in all 2,050 names.

This work is really, as it is described, "a perfect cyclopædia of information concerning the lives, styles, schools, and works" of artists of the period it purports to cover. "Including so many subjects," says the prospectus, "it cannot within the limits of two volumes discuss artists and schools of Art exhaustively;

indeed, such discussion is not the object of the work, but to embrace in convenient compass such personal, characteristic, and artistic facts regarding artists of the century as will make the work indispensable for reference, and a great convenience for artists and Art-lovers and students. Critical estimates from competent authorities, and full indexes, add largely to the value and practical utility of the work." Such examination of the work as we have been enabled to give it assures us that the task undertaken by Mrs. Clement and Mr. Hutton has been performed with great care, diligence, and success. The publishers are Houghton, Osgood & Co., of Boston.

KANSAS HISTORICAL COLLECTIONS. Vols. 1 and 2, 1875-80; by F. G. Adams, Secretary. Published by the Kansas State Historical Society, Topeka, Kan.

This volume is made up of the first and second biennial reports, together with a statement of the collections of the Society, from its organization in 1875, to January, 1881. An inspection of the copious indices of this volume shows what a vast amount of material of the early history of Kansas, Judge Adams has gathered up in a reliable form and preserved for the future historian of this State. Judge Adams seems to possess the necessary requisites for the secretaryship of such a society, and in the present volume he has given full proof of his mission. No State possesses a more thrilling, early history than Kansas, and no State has done more to render that history accessible to the world through its Historical Society.

THE SCHOOL OF LIFE. By W. R. Alger, 16 mo., pp. 205. Roberts Brothers, Boston, 1881. For sale by Kansas Book and News Company.

This volume is foreshadowed in the following passage from the introduction: "The earth has frequently been called a vale of tears, trodden by mourners; a desert threaded with caravans of pilgrims; a bower of pleasure, inhabited by careless flutterers; a gloomy prison, occupied by convicts on probation; a tent, in which immortal travelers encamp for a night; a ship sailing around the zodiac, the generations, its successive crews; a temple dedicated to worship, the human race its natural priesthood; and so on, with scarcely an end. But, on the whole, no other comparison of it is so satisfactory as that which likens it to a school, and describes the business of its occupants as the pursuit of an education fitting them to graduate into the invisible university of God." Likening the world to a school the author goes on to treat of the rooms of the school, the founder, the providential, general and special teachers, and the various lessons learned. The book contains the same characteristics as former volumes, by the same author, such as "The Genius of Solitude," and "The Friendships of Women." Many rich passages are in store for the reader and many sweet thoughts find an echo in the heart, and as one rises from the perusal of the book he resolves to have a

larger faith in the possibilities of life, to put forth more energy in preparation for that which lies beyond and to be more resigned to the inevitable—the limitations of our being. One must regret, however, that so sweet a writer as Mr. Alger should allow the divine benevolence to overshadow the other attributes of the Divine Being. The book will doubtless have a large sale.

How to Tell the Parts of Speech. By Rev. Edwin A. Abbott, D. D., 16 mo. pp. 143. Roberts Brothers, Boston, 1881. For sale by Kansas Book and News Company.

In this hand-book the author attempts to eliminate the vernacular from the Latin nomenclature which grammarians have fastened upon it. The inflections of the Latin language have no correspondence in the uninflected English, and it is impossible to find English things for Latin names. English words must be classified according to their *functions* in the sentence. Taking this as a key to unlock the mysteries of English grammar, the author thinks that a very young child may be taught almost without knowing it, the various parts of speech. Some intelligent teachers have already pursued this plan with success, and this hand-book may be made very valuable to teachers. The English language unfolds more easily under natural methods.

EDITORIAL NOTES.

The Cincinnati meeting of the American Association began on the 17th of August, and in spite of the prospect of hot weather, attracted the largest attendance of any meeting in the history of the Association, except that of last year at Boston. Many of the leading scientific men from all parts of the country were present and papers of much interest and value were read in the various sections. We have given a very full synopsis of the Proceedings of the Association in this number of the Review, and we hope in future numbers to publish some papers in full which seem more immediately to demand attention as contributions to science. The members of the local committee were indefatigable in their efforts to make everything move on smoothly and happily, and the hospitality of Cincinnati was boundless. The proposed changes in the constitution were effected by which the number of sub-sections was increased, and some other alterations made which it is believed will add to the value of future meetings. The meeting of next year will be at Montreal. Excursions to Madisonville, Chattanooga and Mammoth Cave were organized and a large number of the Association enjoyed these trips, where science and pleasure seeking are so pleasantly combined.

WE see by the *American Art Review* that M. Bastien Lepage's Joan of Arc, which was pronounced one of the masterpieces of the last *salon*, has been bought for a gentleman of New York City, by Mr. J. Alden Weir, the artist who visited Paris during the summer. Hans Markart's last picture Diana and her Nymphs, a work of very large dimensions, is also said to have passed into the possession of an American collector.

PROF. SNOW, of the University, had a narrow escape from the Apaches. His party were obliged to leave their baggage, and passed the wagons of the party that were slain, seeing their blood hardly dried. Hundreds of friends will rejoice at his escape.—*Kansas Telephone.*

WE recently spent a day with Dr. I. D. Heath, of Wyandotte, and found, among his collections, specimens of the woods of Wyandotte county, which are in preparation for the Bismarck Fair. The following woods were noted: Burr Oak, Hackberry, Locust, Linden, White Oak, Slippery Elm, Wild Plum, Shell Bark Hickory, Sumach, Mulberry, Black Walnut, Dogwood, Wild Cherry, White Ash, Grape Vine, Black Jack, Red Bud, Black Oak, Papaw, Prickly Ash, White Elm, Water Willow, Water Oak, Pig Nut Hickory, Iron Wood, Chinquapin Oak, Red Thorn, Box Elder, Coffee Bean, Sycamore, Water Beech, Pecan, Soft Maple, Crab Apple, Elder, Buck Eye and Cottonwood. The woods for exhibition will be sawed into sections six inches in length, and the sections according to the size of the tree, halved or quartered. Half of the pieces will be polished and treated with shellac, the other half alternately left so that the grain of the wood may be seen.

THE recent meeting of the American Pharmaceutical Association was an *event* in the history of Kansas City, and we made arrangements to publish a *resumé* of the proceedings. But as the report was somewhat delayed we have deferred its publication until the next number of the REVIEW.

IT affords us pleasure to call attention to Spalding's Commercial College. It has been in continuous and successful operation for sixteen years, and offers unsurpassed facilities for instruction in English and Commercial branches, having an able faculty of experienced teachers and lecturers. Over three thousand students have been in attendance since its organization, hundreds of whom are now filling high positions of profit and trust as bankers and business men in different parts of the country. The writer has known Mr. Spalding since he was a student in the University of Michigan, extending over a period of thirty years, and, therefore, speaks from personal knowledge. In private life he is irreproachable, in his profession he is one of the most indefatigable workers, as a penman he almost equals Mr. Spencer himself, and as a pen-artist he excels him, as a teacher of commercial branches he trains his students into the most careful business habits, and inspires them with a high and noble ideal of their calling, as a friend to indigent students struggling to secure an education, he will be remembered with gratitude by many a business man, and as an author he will soon be known as having published some of the best books in his department. The College was never as successful as during the present year, and the founder of such an institution deserves success.

ITEMS FROM PERIODICALS.

A new magazine, especially designed to represent South Kensington, will very shortly appear, and deal with matters of science and art. The editor says the *Athenæum* is an archæologist and quondam collector.

Van Nostrand's Engineering Magazine for August has a good table of contents. This journal has made itself a necessity to those working in its line of thought.

THE *Journal of the Franklin Institute* for August has an important article in regard to the "wearing capacity of steel rails in relation to their chemical composition and physical properties." The number contains valuable information in its department.

KANSAS CITY

Review of Science and Industry,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

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GEOLOGY.

THE BURLINGTON GRAVEL BEDS.

PROF. J. D. PARKER, KANSAS CITY, MO.

In the summer of 1870, while living at Burlington, Kansas, Shell Island, a pleasant summer resort for bathing in the Neosho River, a short distance below the city, attracted my attention. The island was composed of the finest silicious gravel that I had ever seen. Some pieces of chert were of a red variety, while the brown shades prevailed, the gravel in mass presenting a reddish brown appearance that was quite pleasant to the eye. An expert says the color of the chert runs from a light to a dark shade of Italian pink, as oil colors are known to artists. The gravel bed contained a slight detritus of sand with a few bivalve shells, but otherwise had been washed by the river as pure as glass, and formed a royal bathing beach that anyone might covet.

It seemed impossible that such a mass of gravel should be an accidental deposit in the river bed. The query naturally arose—whence the origin of this beautiful chert? Soon a stratum of gravel was discovered outcropping in the river banks. The stratum was traced up and down the river for some distance, and found to vary in thickness from a few inches to two or three feet, but it always presented the same general characteristics. In most places it rested immediately upon the limestone, and was the water-bearing stratum of that locality. In many wells a saucer-shaped chamber was blasted out of the underlying rock as a receptacle for the water which flowed in from the superimposed gravel as clear as crystal. Soon in my rambles, as the gravel stratum was traced up the affluents

of the Neosho River, it was found not to be a mere fluviatile deposit, but to have a wide geological distribution. The chert was found as far south as Oswego, and as far north as Emporia, and persons reported that the same kind of gravel was found in Fall River and in the Marias de Cygnes. But as the greatest development occurred at Burlington, the deposit was naturally called the Burlington Gravel Beds.

Fortunately Prof. Mudge visited Burlington that summer, and we examined the beds together. He said the deposit was the result of glacial action subsequently modified, and might be termed modified drift. The sharp edges of the gravel left from original fracture had disappeared in the ceaseless roll of the primal ocean. Still the hardness of the chert, which struck against a file gives forth a stream of fire, had resisted to a large extent the friction incident to the ocean. He thought the gravel would prove of value as a macadam for streets, and as ballasting for railroads. The results of our examination were embodied in a paper which was read before the Kansas Academy of Science at the autumn meeting.

Since the discovery of the beds in 1870, I have tried to bring the value of the gravel as a macadam to public notice. Mr. N. P. Garretson. of Burlington, sent by request a sack of the gravel to Kansas City for examination. General George H. Nettleton caused several car loads of the gravel to be transported to Kansas City, and put into the walks at his residence to test its properties for this purpose. Mr. Robert Gillham, a civil engineer of Kansas City, was induced to visit Burlington last year to examine the beds. His conclusions were so favorable that he read a paper on the subject at the last meeting of the Kansas Academy of Science. He estimated that Shell Island contained 1500 car loads of gravel. I find the island at low water is 150 paces in length by ninety paces in width, forming an irregular oval, and the deposit is six to eight feet in thickness above low water-mark, and may extend several feet below it. And the freshets bring the gravel down the river perhaps as fast as it can be used. But the geological stratum underlies the whole region, and in the extension of the Kansas City, Burlington & Santa Fe Railroad, it will probably be laid bare in cuts for miles where the gravel, which lies near the surface as we go west from Burlington, can be shoveled immediately upon the cars. In one of the affluents of the Neosho River, three or four miles southwest of Burlington, I found the gravel stratum, outcropping in the banks of the creek near the surface of the ground, about four feet in thickness. The railroad, I noticed, has also laid bare the gravel deposit in many cuts between Burlington and Williamsburg, and Mr. James Houston, Division Superintendent of the Kansas City, Burlington & Santa Fe Railroad, reports a hill of gravel near the railroad track this side of Burlington.

This gravel has been laid upon the streets of Burlington as a macadam, for several years. Laid immediately upon the ground, however, it has lacked a solid foundation to support the pressure to which it has been subjected in wet weather particularly in the spring, when the ground is soft and porous.

The heaviest wagons would at such times cut through the macadam, mud would be transported by the wheels upon it, and the gravel has had a tendency

in wet, muddy weather to roll up in masses along the road. The fault does not lie, however, in the gravel, but in the lack of a firm foundation of stone. During dry weather the gravel packs and forms a solid macadam as smooth as a floor, and under the roll of wheels rings like iron. The silex containing oxide of iron fractures and powders a little under the grinding action of wheels, but does not crush, and this with a little sand contained in the gravel is sufficient for packing purposes. Burlington probably has the finest macadamized streets, and the best well water, of any town in Kansas.

To gravel a street, or in the language of engineers to lay a Telford road, there needs first to be made a stone foundation inclining a little both ways toward the gutters to drain off the water, and this should receive a dressing of gravel from four to six inches in thickness which should be rolled down smooth with a heavy iron roller. Our native limestone laid on its edges makes a good foundation. With proper repairs such a road of gravel would last a generation. I am inclined to think the gravel may not withstand the wear and tear of our heaviest business thoroughfares like Fifth street, but for residence streets, and lighter business streets, the gravel would be durable and beautiful. If Penn street could receive such a dressing of gravel it would become one of the most charming streets in the west.

Such a graveled street would form a striking contrast to the dressing of native limestone which is now laid upon the streets of Kansas City. The broken limestone is soon ground to powder and turns into dust and mud. The people of Kansas City exhibit, however, a persistence of purpose and action in this respect, worthy of a better cause. When one dressing of limestone stone blows away in the equinoctial gales and disappears, they immediately commence to lay down another. Thus one dressing succeeds another as the seasons come and go, even the leaves of the forest scarcely strew the ground more regularly from year to year, than are limestone dressings laid upon the streets of Kansas City. And all this toilsome and expensive work is carried on amidst discouraging circumstances, clouds of dust filling the air, and rivers of mud at times running down the streets —still the people are not disheartened. Gradually the bluffs melt away while the houses are filled with dust and the streets rendered almost impassable; still the stone hammer breaking limestone may be heard under the bluff, and for aught that now appears, may continue to click to the end of time. Such persistence in any people is worthy of special notice.

The broken limestone now laid upon the streets of Kansas City is also injurious to public health. Under the friction of wheels the limestone is soon reduced to powder, and fills the air with a fine dust which in dry weather is almost insufferable. A wagon passing down Broadway during the late dry season was almost hidden from my view, fortunately the heads of the occupants of the wagon appeared above the cloud of dust to show where the wagon was. This fine dust enters the lungs at every breath as a foreign substance to induce disease. A physician informs me that he was compelled during the late hot weather to close the windows of the room on the side of the avenue to shut out the dust, and to

use an atomizer to settle the dust in the room, before his patient, who had a bronchial disease, could find any rest or relief. In the minds of those who are best informed on this subject this single objection would be sufficient to exclude the limestone as a dressing for our streets.

The limestone dressing is also objectionable in its injurious effects upon the eye. The white glittering light reflected in a bright sun from the freshly broken limestone is very trying to the eyes. Persons whose eyes are not very strong cannot endure it, and turn away for relief from the glittering light. A surgeon informs me that during the late war while in camp on the white sands of Florida he blackened the tents of the soldiers and thus emptied his hospital of patients having sore eyes, while the hospitals of those regiments whose tents were white-washed were full of patients from sore eyes. The census of 1870 reported over 20,000 blind persons in the United States. If we count the pur blind, and those who cannot see to read, this number would probably be more than doubled. The estimate at the present time is placed as high as 50,000. Certainly no intelligent people would multiply the causes of blindness. They would not spread their streets from year to year with a substance whose optical effects are recognized by the best authorities as highly injurious.

It only remains to speak of the supply and cost of the Burlington gravel. Captain Trowbridge has kindly furnished me some estimates on this subject, published with this paper, which I think can be reduced considerably. As the foundation of stone will be the same with the gravel and broken limestone dressing, we can drop it out of the estimate. The cleanly washed gravel from Shell Island can be purchased, I am informed, at fifty cents a royalty by the carload. But the stratum of gravel underlies the whole country, and west of Burlington in many places it lies on the very surface, sometimes nearly four feet in thickness, and can be obtained in unlimited quantities. The beds only need to be developed, and can never be exhausted. Gravel also exists in large quantities in the Marias des Cygnes. The railroad now offers to bring the gravel from Burlington to Kansas City for $15.00 a carload, and it is thought it can be brought in large quantities at $10.00 a carload. Now if it will last ten times as long as the limestone dressing, and judging from the Burlington macadam, it would with proper repairs last a generation, we can easily see in the long run how much cheaper it would be than the limestone. And the fact that the limestone is now broken without expense to the city does not avail as the same force can be employed in putting down the stone foundation, and thus free labor from the work-house made of some profit to the city.

I have submitted packages of the Burlington gravel to various experts, and herewith publish their opinions:

Prof. C. F. Chandler, chemist of the School of Mines, of Columbia College, New York, writes: "In reply to your letter I would say that the sample of gravel you sent me seems to be *admirably* adapted for macadamizing."

Dr. John Fee, city physician, with whose writings in reference to the eye and color blindness the public are familiar, writes: "The limestone that is broken and placed upon our streets as a macadam has a white, glittering appearance that is quite trying and injurious to the eye. I should regard the chert from the Burlington Gravel Beds as a great improvement to the limestone in its optical effects."

Dr. T. J. Eaton, chemist of the Kansas City Medical College, writes: "I have examined the sample of chert (or Burlington gravel). It seems to be one of the sub-varieties of the numerous quartz family. It has the colors of jasper, the hardness of flint, but a little more brittle than the latter. Its physical and chemical properties render it one of the best macadamizing agents known. Its hardness would make it durable. Its color is easy on the eye. Its brittleness is just right to make it pack properly on streets that are much used. While mixed with a small proportion of our best limestone, it would pack all right for residence streets. I hope to see a test made of it on some of our streets in Kansas City. If it proves practically what it promises theoretically, and the cost of getting it here is not too great, it will soon supplant the miserable stuff we are now spreading on our streets.

Capt. J. M. Trowbridge, late city engineer of Kansas City, writes: "From such very limited samples of the Burlington gravel as I have seen, I am of opinion that the wearing qualities are of the highest order. It is a silicious gravel made up principally, so far as my limited opportunities of observation go, of jasper, and other kindred minerals, differing principally in color though not in texture or in hardness. Besides being hard it is tough, quite as necessary a quality for a pavement as hardness. It resists a shock or concussion as well as it resists abrasion. This quality will be better understood by comparing it with glass. Glass is hard, but it is fragile, reduces to powder easily, and if available, would be unsuited to paving purposes on that account. So with a certain silicious strata in the limestone of Kansas City. It is quite hard, and flinty in appearance and characteristics. It resists the drill, but spoils or chips with the utmost freedom, and would reduce to sand or wear out under the traffic of our streets with great rapidity. The Burlington gravel would do neither.

"Again its general shape, flat and thin, rather than round or cubical, gives it additional value for this purpose. It were easy to show, both theoretically and practically, the value of that form, but I need not lengthen this note for that purpose.

"There are in my judgment only two questions concerning this material; those are cost and binding, or cohesive qualities. Some gravels, as that at Cape Girardeau, possess this binding property in an eminent degree. Thrown loosely upon a grade, it packs very quickly into a compact solid road-bed. Others though hard and tough fail in this quality, and never give a compact surface. Perhaps this question is already favorably decided by the trials at Burlington, where, I understand, it has been in use for years with satisfaction in this respect.

"Concerning cost here I have very grave doubts—not but that it *could* be afforded cheap enough, but because it would be so nice a thing to be (virtual) sole proprietor of the only available material for paving a prosperous, thriving but muddy city of 75,000 inhabitants.

"I append a few notes of approximate cost drawn from correspondence on the subject a year or two since. Under the most favorable circumstances, no less a thickness of gravel than four inches will answer. Assuming that our cheap limestone has been used to sheath over the road-bed. With a sixty foot street, two twelve-foot sidewalks and two six-foot gutters, there remains twenty-four feet of road-bed for traffic, and consequently to be graveled or paved. Twenty-four by one-third feet, equal eight cubic feet per running-foot. Eight cubic feet of this material will weigh fully 1,000 pounds, and a carload of 24,000 pounds will dress just twenty-four feet in length. I understand that this gravel will cost say per car-load (7 cubic yards) $3.50 in the bed; $2.00 for loading; $15.00 for transportation from Burlington to Kansas City, and $7.50 for hauling and spreading on street. Total $28.00, besides cost of paving and grading, say fifty dollars more, making all told about $80.00 per twenty-five feet front by twenty-four feet wide."

Robert Gillham, civil engineer of Kansas City, writes: "I visited Burlington by request and investigated the gravel beds. My examinations embraced a large portion of the surrounding country. Outcroppings may be found along the banks of the Neosho River, and creeks emptying into it. In my opinion the beds cover a large area, having traced it as far south as Oswego, and as far north as Emporia. It can be seen present in many cuts along the railroads in eastern Kansas and western Missouri. The gravel at Burlington varies in depth below the surface, and several miles west of the town it may be seen at the surface.

"The maximum depth as found by the tests resorted to, was sixteen feet below the surface and will probably average nearly three feet in thickness, and is usually the water-bearing stratum throughout the surrounding country. When property owners, in sinking wells, meet the gravel they are sure of water possessing most excellent qualities.

"In the Neosho River at Burlington large beds have been forming for a number of years, the gravel being transported from creeks and rivers emptying into it, during high water. These beds of gravel are available in quantity, and may be shipped to any point by rail.

"The gravel may be used successfully on residence streets in any town or city, and laid at a very small cost. The street should be excavated to the required depth and width, a good foundation of broken stone laid, followed by 4″ of pit gravel well rolled, followed again with another layer, and so continue until sufficient covering has been used and the whole becomes hard and compact.

"With proper care the Burlington gravel will give great satisfaction in making streets and roads, which will be more durable than the ordinary macadam road. I am fully convinced that these gravel deposits are valuable, and may be developed with profit. Geologically considered the beds are doubtless modified

drift, having been modified during subsequent geological changes, breaking up and entirely changing their original depositions and distribution."

In gathering material for this paper, I wish to make grateful acknowledgments to Gen. George H. Nettleton for railroad courtesies, and to Messrs. Scott, Grimes and Garretson, of Burlington, for special favors fitted to gladden the heart of a scientist.

ORIGIN AND USES OF ASPHALT.

BY LEON MALO, C. E.

Bitumen appears in nature as an accidental mineralogical product, under the the most diverse and often most inexplicable conditions. It is found sometimes in the native state, sometimes mixed with clays, sometimes as the cement of conglomerates, sometimes impregnating limestones. The last combination produces the mineral commonly called asphalt. When the bitumen contained in any of these substances is chemically isolated, it appears always a nearly identical substance, in composition, consistency, and appearance, except that the empyreumatic odor that characterizes it may become alliaceous in volcanic countries. Asphalt is doubtless one of the most considerable and valuable of the forms in which bitumen appears. It is a soft limestone, naturally and closely impregnated with that substance. When a specimen of it is examined under the microscope, each grain of it appears to be immersed in a pellicle of pure bitumen, by which it is cemented to the adjoining particles. It is thus a species of very fine-grained bituminous conglomerate. When a lump of this rock is heated to a temperature rising from 176° to 212°, the pellicle of bitumen melted, the cohesion of the asphalt is destroyed, and it crumbles into dust. If it is taken while it is still hot, or if it is heated again after it has become cool, and strongly compressed, the particles will adhere again, and the stone will recover, after cooling, precisely the consistency and appearance it had originally. The employment of compressed asphalt for pavements is founded on this property.

Asphalt, or bituminous limestone, is generally found in the Jurassic strata, in regular beds of a lenticular shape, which are uniformly cut into by a stream of water. Sometimes the bed is single, at other times it is multiple; there are formations containing seven beds, one above the other, and distinctly separated by strata of white limestone.

Different views prevail respecting the origin of asphalt and the circumstances under which it is formed. Some believe that the bitumen was already in existence when the calcareous formation took place, and that the particles of limestone were deposited in a bituminous sea. Others consider that the bituminous matter is derived from the organic matter associated with the shells that have furnished the carbonate of lime; and other more hazardous hypotheses have been advanced.

A careful observation of asphaltic formations has led me to adopt what appears to me to be a more plausible theory.

It is permitted to suppose, from indications furnished by the study of bituminous districts, that in some geological epochs, which have yet been only imperfectly determined, accumulations of organic matter, buried under enormous masses of Jurassic limestone, and heated by the central fire, became vaporized, and in that condition sought a passage through the crust of the earth. In time the crust cracked, and a fissure was formed. The bituminous vapors, compressed by incalculable pressure, forced themselves through the way that was opened to them, and passed by such strata as were too compact to be penetrated; but, when they reached the oölite, they found on either side of the fissure, beds of a limestone soft enough to admit of their impregnating it. As long as the pressure lasted, the bitumen continued to insinuate itself through the pores of the limestone, and to fill its infinitesimal cavities.

Mineral asphalt is relatively a soft stone. It becomes more compact as the temperature diminishes, but yields under the influence of heat to such a degree that an exposure of a few days to the summer sun will sometimes cause it to crumble. This property has induced the application of the compressed material to the making of pavements. Its fitness for this purpose seems to have been suggested by accident. When the mineral was first quarried, the pieces which fell along the road from the wagons carrying it were ground up by the wheels, and were finally compressed again by the continued passage of the wagons over the dust, so far as to form a kind of spontaneous pavement. A Swiss engineer, M. Mérian, acting upon the suggestion of this incident, asphalted a part of the road from Travers to Pontarlier, in a rough way, but with a satisfactory result. In the next year (1850), M. Darcy, inspector-general of bridges and highways, recommended asphalt as a material for pavements in a report to the Minister of Public Works. The first asphaltic pavement was laid in Paris in 1854.

The mineral appears in industry, under a still more useful form than the compressed form, as asphaltic mastic. This is made by throwing the powdered mineral into a bath of seven or eight per cent. of its weight of liquid bitumen, and mixing the whole thoroughly while it is cooked for five or six hours. The substance produced, although chemically the same, except for the difference in the relative proportions of bitumen and limestone, is physically entirely different from asphalt. It cannot be pulverized by heating, but forms a paste in which the two ingredients seem to be perfectly combined, and which may be molded into desired forms. The manufacture of the mastic has become an important industry. The annual production of the French shops alone must amount to fifteen or twenty thousand tons.

In "La Nature," of April 9th, Mr. A. Woeikofen, of St. Petersburg, describes the asphaltic beds of Russia, which occur on the grand curve of the Volga, or the arc of Samara, a short distance above the city of Syzran. They are not deposited in the Jurassic formation, as are those in France, Switzerland, and

Germany, but in a dolomitic limestone of the lower Carboniferous series. The mineral is rich in bitumen, of less fusible quality than the bitumens of France and Switzerland, and has not been produced in the compressed form. It is extensively made into mastic, the fabrication of which already amounts to ten thousand tons a year, and is rapidly increasing.—*La Nature.*

ANTHROPOLOGY.

THE STUDY OF MANKIND.

BY ALEXANDER WINCHELL.

* * The science of man in its broad sense is understood to embrace the comparative anatomy of races, their intellectual, moral, social, religious and industrial conditions, and the progressive development of modern conditions out of primitive conditions. The search for primitive conditions leads us into the field of archæology, both historic and prehistoric. The study of the evolution of modern conditions necessitates the discovery of the organic principles of sociology and religious life; and the special operation of these principles among the several varieties and conditions of mankind, united with the structural characteristics of races, brings into requisition the whole of the well recognized science of ethnology. Anthropology, in this broad and just, and important sense, is a new science, constituted during the lifetime of the present generation.

It is this science which Mr. Tylor undertakes to pioneer into popular favor and acquaintanceship. His researches and writings for many years past have given him a masterly familiarity with the sociological, industrial and religious aspects of humanity in primitive conditions; and if he is not an equal master of ethnology and archæology, he is at least a fit person to offer the general reader this Introduction. The field of anthropology is vast, and the present work attempts little more than to guide the reader to its borders and point out its extent and attractiveness. A happy preliminary chapter affords a conspectus of the materials and methods of investigation. It directs attention to the familiar facts of racial, linguistic, and cultural differentiations, on which may be based well-known inferences concerning the laws of divergences, and the high antiquity from which they must have proceeded. The body of the work begins with a comparison between man and the lower animals in respect to bodily structure and psychic powers. Mr. Taylor is quite positive that the higher attributes of man are possessed in the germ by some of the orders beneath him, holding that even lower animals have the faculty of forming some of the simplest abstract conceptions. The chapter devoted to human races, while neither full nor original, is copiously illustrated by fresh and telling portraits which supply large deficiencies

of text. Mankind are regarded as one species zoölogically, and the races are considered as different "breeds." The white race is the last differentiated. A black type once stretched from Africa to the Philippine Islands and New Guinea, and is still represented by Negroes, Mincopies, Aëtas, and Papuans. Man is thought to have appeared in the New World and the Old in a geological period earlier than the present, perhaps a time "when there was no ocean between" "the Mongols and the North American Indians."

Languages and their progressive differentiation are treated with considerable fullness of illustration, from the rude sign-and-gesture language of lower animals and children to articulate language and written signs or ideas and of speech. Imitative gestures are the natural language of the simplest human condition. The first vocal utterances are emotional and most inarticulate. The next stage of articulate speech is chiefly imitative, and hence very similar words occur in widely distinct languages. We employ the term articulate to denote the articulations or joints of a vocal sound, effected by the alternation of vowels and consonants; though Mr. Tylor applies it, unadvisedly, we think, to the joints of a sentence. The author's view of sentence-building and its progressive development is intelligent and sound. As to the relation between language and race, he is wise in pronouncing it an uncertain criterion of ethnic distinctions. Generally, people of one ethnic stock speak one or more dialects of one original language; but manifestly some, by captivity, by neighborhood of a superior race, or by other causes, may be led to employ a language unknown to their ancestors. Yet affinity of languages must always be assumed as evidence, *prima facie*, of ethnic consanguinity. The linguistic stocks of the White race are mostly Aryan and Semitic. The Egyptian language, either by absorption or inheritance, possesses many Semitic elements. No success has been attained in the effort to trace Aryan and Semitic languages to an older parent tongue. The Tatar nations speak languages of a distinct family. The Chinese and Indo-Chinese show obvious kinship, though after a long process of differentiation. The Chinese and Siamese languages are far removed from a *primitive* condition. Though possessing monosyllabic and grammatical simplicity, this is rather the outcome of long attrition and disintegration than of a formative stage. The Akkadian tongue, spoken by the first settlers of Babylonia, "shows analogies which may connect it with the Tatar or Mongolian languages." We would suggest, however, that this does not show the primitive Babylonians to have been Mongoloids, since, as we believe, the Akkadian tongue was Hamitic, and acquired Tatar elements only through contact with subjugated aboriginal Mongoloids, who were the predecessors of the White race in all Western Asia. Another family of languages is the Dravidian, of India. The Polynesian Blacks, whether racially connected with African Negroes or not, speak languages which stand apart, and constitute a separate family. In South Africa the great body of Blacks speak Bantu languages, though the Mandingoes stand apart. The speech of the Hottentot-Bushman is also fundamentally distinct. In America, linguistic diversification has been carried to a great extent and a number of distinct families must be recognized. All the languages of the

world may be reduced, perhaps, to fifty or one hundred families. Little progress has yet been made in tracing these to one or several ancestral stocks. The author's account of the development of writing is brief, but admirably presented.

In approaching the subject of the arts of life, Mr. Tylor is on ground perfectly familiar to himself, and which he has made familiar to the reading public through previous volumes and numerous memoirs in the ethnological and anthropological journals. No man is able to speak with higher authority. It is not surprising that he has given his favorite and most familiar themes the amplest development in this volume. One unacquainted with the author's previous publications may find the gist of them in these chapters and the following. We find here, for instance, elementary statements of the evolution of many of the implements and mechanical combinations of civilized life, such as spears, axes and knife, wheel-carriages, mills and plows, methods of hunting, fishing, and war, dwellings, personal ornamentation and clothing, navigation, cookery, pottery, metal working, money, and commerce. These subjects have been separately elaborated by the author, at adequate length, in the anthropological journals; and the reader is here furnished outlines and conclusions from investigations of new and striking interest. On the development of the arts of pleasure and the sciences the author has been equally happy and original.

One of the characteristic doctrines of the author, and one largely elucidated in his previous works, has been designated "animism," and this subject is treated with relative fulness in the present work, in the chapter entitled "The Spirit World." Mr. Tylor entertains the opinion that the idea of the soul is the foundation of all savage religions. Savages universally believe that the soul may exist and act independently of the body. The souls of the dead continue in existence, and frequent their former abodes, and possess some power over the fortunes of their surviving relatives. Souls, which are otherwise contemplated as spirits and demons, may be moved by good or by evil motives. They bring prosperity or sickness and misfortune. Men, therefore, begin to propitiate them. The souls of ancestors acquire higher and higher dignity, and are held in ever increasing reverence. The souls of great chiefs and warriors assume a divine character. Their names become the names of gods. Thus the Mongols worship as good deities the great Genghis Khan and his princely family. "The idea of the divine ancestor may even be carried far enough to reach supreme deity, as where the Zulus, working back from ghostly ancestor to ancestor, talk of Unkulunkulu, the Old-Old-One, as the creator of the world." This is the extreme development of animism. The theory is highly ingenious and we have an enormous array of facts which admit of coördination under it. There is, we believe, much truth in the doctrine; but our own study of comparative religion leads to the conviction that the savage notion of a supreme being is not the outcome of any animistic tendency, but a gift incorporated in the constitution of the psychic nature of man. We are inclined to think that it is the initial rather than the final term in animistic progress. This intuitive notion of an invisible Supreme suggests the notion of invisible powers of lower orders. In man is an invisible and powerful entity;

in the tree, in the sky, in the sun, are other powerful existences, all kindred with the spirit which sustains the universe, but inferior, and generally subordinated. Mr. Tylor argues that religious anthropomorphism confirms this doctrine of the evolution of gods from human souls. We think, on the contrary, that the barbaric notion of divine being and power is anthropomorphic; for the simple reason that "man is the measure of all things," and is compelled to think divinity in terms of humanity. Mr. Tylor travels over familiar ground in his concluding discussion on the beginning and development, significance and relations, of history and mythology, and on the organization of society.

We have no space for any fuller analysis of this work, for which the public are under great obligations to the author and the American publ sher.. It deserves high commendation. Its drawbacks are few and not serious. We do not think the author has given a justly proportionate development to the physical characteristics of races, and their relations to the regions which they inhabit. Ethnology is subordinate, and *man* is the central idea of the work. We can anticipate the justification of this mode of treatment; but we think *man*, attentively considered, leads our thoughts down to racial distinctions, race origins, chorographic relations, and ethnic movements. We think, too, a treatise on anthropology might well give a fuller view of prehistoric archæology, even to the omission of some of the copious illustrations of language-formation and the arts of life. The work aims to be elementary, and for this reason, undoubtedly, some matters were abbreviated, and others almost om tted; but it is hardly symmetrical. It seems ungracious to make even these exceptions to its excellence; but we must permit ourselves also to express discontent at the author's manifest effort especially in the earlier chapters, to write in a very simple style. He has merely fallen into the use of expressions which are needlessly inelegant and ungraceful. Thus, in several places he speaks of "the lie of the land." Other objectionable expressions are "the un-English looking group of animals;" "man's being the tool-using animal;" "traces of the letters having been made;" "anyone who happens to have been up country in America." These errors of form, however, are venial, and we welcome to our literature, in this work, a contribution which is a substantial and creditable addition.—*The Dial.*

THE SACRIFICIAL STONE OF THE CITY OF MEXICO, IS IT GENUINE OR NOT?

BY EDWARD PALMER.

In the city of Mexico are offered for sale, casts in plaster of the so-called sacrificial stone now in the courtyard of the museum in the city Mexico, of which much has been written to prove its genuineness. These casts are much reduced in size, and do not contain the groove of the original. The maker, like many of his countrymen living in the city of Mexico, may not believe in the genuineness

of this stone's history; many assert that it was not the sacrificial stone of the Aztecs used in the city of Mexico. No doubt the basin in the center, and groove running from it across the top and down the sides were made after the ornamentation was completed. As this is claimed to represent the journeying of the Aztecs to the city of Mexico, why did they not cut the groove first, then the historical representation? As it is, the figures through which the groove is cut, are partially effaced. The groove was evidently cut after the completion of the stone, and in a very rough, uneven manner, passing through the figures in order to give a false importance to a carved stone, which, if allowed to tell its own tale, or, rather, if its history had not been destroyed so as to attach a false representation to it, would still be a valuable monument.

One would think that an object designed for so important a purpose, would have been dressed into shape at the same time, without having to pick up an accidental stone and improvise it for an occasion. If the figures on the surface represent the journeying of the Aztecs to the valley of Mexico, then it did not take many to form the procession. Is there not a great probability that this so-called sacrificial stone had a useful purpose? We are led to this conclusion by seeing scattered about many large round stones, both plain and ornamented, yet without grooves. In the old mills of the early Spaniards, are to be found the very counterparts of these. And why did the Indians want a stone with a hole in it, to retain the heads of prisoners as they were severed? A round object allowing the head to hang over so as to bare the neck for the knife, would be better adapted for the purpose, than to lay the head in a hole with the neck contracted. Is it proved that the Aztecs cut off the heads of their victims? All the stone knives the writer has seen with edges of sufficient length, strength and sharpness, would be poor, slow tools for the cutting off of the numerous heads said to have been daily removed by Montezuma. In the collection of antiquities are several obsidian knives marked "sacrificial knives used by the Aztecs," all of which are better adapted to cut off the tops from turnips and carrots, than human heads, especially if bones were suddenly hit, as the brittleness of these knives would be their speedy destruction. If these so-called Aztecs burnt their dead as a national custom, why accuse them of cutting off human heads to appease their gods? It was only giving the Spanish priests a pretext to call them idolators; so they called it sacrificing human beings. It was good religious capital to work upon. One proof of their burning their dead is, that no graves have been found in the country they occupied, that are older than the Spanish conquest. The Chichimecs, called Aztecs, could not cut off the heads of all their victims; some would die. Why are they not found? There are three skeletons in the museum of the city of Mexico, which were obtained in the old Inquisition building of the city, of those who were starved to death because of their refusal to yield to church dictation. They find no bodies because they were all burnt according to custom, a usage continued to the present day by their kin the Apache, the Yuma, Mojave and others,—plain, simple Indians, not fond of the pageantry

attributed to them by the conquerors, who must fictitiously give them importance in order to throw reflected greatness upon their conquest.—*American Naturalist.*

ANCIENT PUEBLO WORKSHOP.

BY E. A. BARBER.

On the north bank of the Rio San Juan, in Southern Utah, about twenty or thirty miles below the mouth of the Mancos cañon, in the summer of 1875, I discovered the site of an ancient aboriginal workshop, where axes and hatchets had formerly been made in large numbers. On an elevated ledge overlooking the river, I gathered together in the space of half an hour, upwards of twenty stone axes of various sizes and in different stages of manufacture. They were all made of the natural, rounded, water-worn stones of the river, such as we call cobble stones, varying in length from four to ten inches. As a general thing, the flat stones, which approach most nearly the desired form, had been selected, and the majority of them had simply a groove roughly chipped out around one end. None of the specimens exhibited any traces of surface-pecking. In some examples the edge had been commenced by flaking off small fragments on each side, whilst a few had been superficially sharpened by abrasion. One highly polished celt, of the long, narrow variety, such as the one figured in Hayden's Report for 1876, Pl. XLVI, Fig. 3, and two or three broken specimens were included in the series. They were all found on the surface, scattered through a large number of stones which had evidently been carried there for the same purpose. The ledge or small plateau on which they were found, did not exceed two hundred feet in length and fifty in width.—*American Naturalist.*

THE NEGRO AS AN IRONWORKER.

The *Iron Age* in discussing the value of the negro as a worker in the manufacture of iron, says:

"For some years a portion, at least, of the workmen at the Old Dominion and Tredegar Iron Works, at Richmond, Va., have been colored men, and as puddlers they have been especially efficient. Some years ago, during a strike at a mill in Pittsburg, a number of colored men were brought from Richmond to Pittsburg as puddlers, and unless a change has been made very recently, the puddling at this mill is still done by negroes. These experiments and their results, successful as they have been, have not been generally known in the South, and when some six months or more ago the Knoxville (Tenn.) Iron Works concluded to try negro labor, it was with some doubt as to the result. To-day, we are assured, the mill in all its departments is run entirely with negro labor—puddling, heating, rolling, shearing, etc. The superintendents are white, but heaters, rollers, roughers, catchers, drag downs, puddlers, helpers, etc., are all colo

ed. At the Atlanta, (Ga.) mill a similar course has been pursued for about two months. The puddling is done by colored labor as well as it was done by white, and as soon as men are taught, the remainder of the work will be done by them. In every case, we are informed, the negro workmen are as efficient as the white."

And in discussing the same subject the Philadelphia *North American* says:

"* * At this moment the negro is the black sceptre through which the South can rule the land. * * The one thing which holds back this country in its wonderful career of development and prosperity and retards its progress is the want of labor. * * The South to-day controls the labor field of this land, and the power which enables her to hold that commanding position is the negro. Under the crucial strain of the last two years our contractors and companies everywhere have been trying every possible expedient to find and hold the labor that they must have. They have tried the men of every race, creed and color, and with remarkable unanimity their judgment is settling down on the negro as the most available and desirable and economical for the rough work of railway construction, mining and tunneling, *i. e.*—the foundation of labor. This is a judgment that has been established by fact, by the patient, silent experiment of years. In the course of inquiries we find that large bodies of negroes from the South have been taken up to Pennsylvania and New York by contractors, worked there for months and returned to their plantation homes. Seven hundred negroes from around Staunton, Va., are now working in one company's mines in Minnesota. A Pennsylvania contractor is now in Colorado negotiating with one of the most vigorous and prosperous railways there for a contract on which he expects to take out and work 2,000 negroes from the far South.

"While the negro may not have the physical stamina of some of the hardier races, he has moral qualifications as a laborer which bring the results of his labor up to their level. He is patient, steady, faithful, if well treated, and trusting. He does not waste his force in strikes or sprees, and his saints' days do not seriously encroach on the volume of the calendar. * * Short of China, the labor field of the world, for us, at the present moment is barren and limited. This is the South's great opportunity. Labor, the foundation of all values, is her staple. The negro, an economic burden under slavery, under freedom has become her chiefest treasure. * * The negro is the stone which the builders have always persistently rejected in the South. They might have made him the corner-stone of a sure political supremacy. They can now make him the foundation of social supremacy and advancement. Will they? The South at this moment has all the material elements of future and near impending empire in greater abundance and wealth than any section of this land or any other. She has raw materials, fertile soils, untold ores and mines, coals, vast undeveloped regions, ready means of transportation, and labor. Can she fuse them? The flux is brains."

It looks to us as if this question of labor in the iron working industries in certain parts of this country finds its solution in the way here indicated. It is no

new and untried experiment, the employing of negro labor in iron manufacturing establishments in this country. Before the war negroes found steady and profitable employment in rolling mills in the South, and the writer had occasion frequently during the war to observe the fact that negroes were almost exclusively employed in such establishments in Richmond and Atlanta, and also in some works on the Etowah River, in Georgia. We have knowledge of some extensive coal mining operations now being carried on in Ohio, the entire force of laborers being negroes, many of whom have acquired homes and worldly goods there as the result of their work—many of them having money to their credit in bank. Some technical education would be necessary of course to fit these people for such duties; but if such a class of labor as is now used, or has been used up to the late strike, becomes unavailable, it would be worth while for manufacturers to turn their faces to the South and at least make the effort to utilize the negro as a worker in iron. The experiment should be tried.—*Age of Steel.*

CHEMISTRY.

WATER GAS.

BY A. P. H.

When steam is brought in contact with incandescent coal or coke, it is de prived of its oxygen, which unites with the carbon, forming carbonic oxide, anc the hydrogen is liberated. If the mixture of these two gases is brought in con tact with the vapor of naphtha it acquires illuminating properties, and is the il luminating gas which is now manufactured on such an extensive scale in Nev York and many other large cities.

The first successful attempt to manufacture this gas was made by Michae Donovan, who obtained a patent for his process in 1830. Soon after, Jobard, Belgian, obtained a patent. Then followed Selligue, Lowe, and others.

The process in most general use now is named after its inventor, Tessie d Motay, and is the one employed by the Municipal and New York gaslight com panies in New York City. The operation is conducted as follows:—

The gasogens in which the water gas is generated are arranged in pairs alon the main pipe, which passes through the center of the building. These gasogen consist of vertical furnaces, constructed of iron and lined with fire brick, an have a capacity of about ten tons of coal. In the lower portion on each side is row of doors for the removal of cinders; on the top are two large openings for th introduction of coal, and a standpipe, which not only extends over to the mai pipe, but has a vertical extension, the end of which can be opened or closed b means of a lid.

Through the center of the furnace is a fire-clay partition, which extends nearly to the top, and in this a coil of iron pipe. In working, a quantity of wood and coal is introduced into the gasogens; the doors are luted and the coal openings on the top closed, but the upper end of the standpipe is allowed to remain open to serve as a chimney. The blast is turned on till the wood is all burnt up, and judging from the color of the flame issuing from the standpipe the mass of coal has become incandescent. The blast is then shut off, steam is let in, and the lid of the standpipe is closed. The steam, which is generated in immense boilers at a high pressure, enters the coil of pipe contained in the fire-clay partition, where it is superheated, and then enters the mass of incandescent coal through a row of openings just above the grate bars. When the steam comes in contact with red-hot coal, the following chemical reaction takes place: $H_2O+C=CO+H_2$. Besides the carbonic oxide and hydrogen, some CH_4, CO_2 and H_2S are formed, and possibly other gases resulting from any impurities which may be contained in the coal. The pressure caused by the generation of these gases force them up the standpipe and over through a water seal into the main pipe; from here the gas enters a small holder, which acts as a governor, causing a steady flow of gas into the carburetters. The carburetters, which are situated at some distance from the gasogens, consist of ten or a dozen shallow trays, arranged one above another and surrounded by a steam jacket. A slow stream of naphtha, about five gallons to the 1000 cubic feet of gas, is allowed to run into the top one; when this gets full it overflows through a small pipe into the next lower, and so on. The heat of the steam in the jacket keeps the naphtha evaporating, and the vapors are taken up by the gas, which enters at the bottom, and after passing back and forth over the trays goes out at the top, and from thence to the retorts. These are about twenty feet long, of the same shape and arranged in the same manner as those used in the manufacture of coal gas; and they have perforated partitions across them in order to retard the flow of gas. These retorts are kept at a red heat. The gas enters at one end through pipes provided with valves for regulating the quantity, and passes out through a standpipe at the other end. The object of passing the gas through these retorts is to "fix" the naphtha vapor so that any lowering of the temperature will not cause a condensation of the illuminating constituents. In order to determine how well this is being accomplished the following simple test is used, which was patented in 1877 by Mr. H. C. Bowen:

A slip of white paper is held in front of a small stopcock attached to the standpipe; on opening the stopcock a small stream of gas strikes the paper, causing a stain, from the color of which the workman is enabled to decide whether the temperature of the retort is right. A brown stain is desired; if it is too dark it indicates that the temperature is too high, and more gas is let in; while if it is too light in color the reverse is the case, and some of the gas is turned off.

From the retorts the gas goes to the exhauster, which forces it through the condensers, scrubbers, purifiers, meters, etc., into the holders, where it is stored

till distributed. The process of condensing, purifying, etc., is essentially the same as that employed for coal gas, the impurities being about the same, with the exception of ammonia, which is seldom found in water gas.

Water gas as it comes from the gasogens, and before it is enriched with naphtha vapor, has a specific gravity about one-half that of atmospheric air, with quite a strong odor, and it burns with a non-luminous flame, producing an intense heat. It consists of about equal parts of carbonic oxide and hydrogen, some marsh gas, carbonic acid, and various other impurities from the coal.

After being enriched and purified it has still a strong odor, and has a specific gravity of about 0.66 compared with air. Its illuminating power differs with the amount of naphtha used, generally ranging from twenty-five to thirty candles. It is more combustible than coal gas, requiring less oxygen to burn it, and therefore should not have as deleterious an effect upon the atmosphere of a room in which it is burned.

When a mixture of water gas and air is exploded, the explosion seems to take place more slowly than in the case of coal gas and air, exerting a steadier pressure with less shock, as is shown by windows being blown out without breaking the glass.

The following is an analysis made by Mr. E. G. Love, city gas tester of the gas furnished by the Municipal company of New York City:—

Hydrogen	26.25
Marsh Gas	28.91
Carbonic Oxide	27.12
Illuminants	15.80
Nitrogen	1.92
	100.00

It is very generally known that water gas can be made more cheaply than coal gas, although both sell for the same price, because their luminous powers are about the same. When electricity shall displace gas for illumination, there will still be a field for water gas as fuel. As the enriching process can be omitted, the price can be reduced so that it will be as cheap as coal.—*Boston Journal of Chemistry.*

CHEMICAL PARADOXES.

We are accustomed to associate the idea of combustibility with paper. If it be wrapped tightly around a metallic rod it can be held in a gas flame without burning. The metal carries the heat away from it as fast as applied, becoming hot itself. After a while it will reach a temperature, provided the flame is large enough, at which the paper will burn.

This same phenomenon can be more strikingly exhibited by making a vessel of paper, filling it with water, and applying heat. No matter how hot the flame

over which it is placed may be, it will not burn. The water will boil, and the heat be absorbed, or rendered latent, in the production of steam. An egg can thus be boiled in a paper saucepan—quite in the Easter vein if we were a little earlier in the season.

A sieve may be made to hold water or to float. If the interstices are very fine and the wire bright and dry, the water will not wet it, because a film of air will adhere to the wires. The lower surface of the water is divided by the meshes into a number of little spheroidal projections, in which the capillary force or internal gravitation and also cohesion come into play. These hold the water together so that some considerable power is required to force the water through the meshes. Thus we can put quite a quantity of water in a fine sieve, or place one in water and it will float. If the wires are not perfectly bright we may distribute over their surface some powder which water will not wet. The dust of bituminous coal is excellent. Carrying out this principle, needles, if bright may be made to float without the least trouble, and will float for a long time.

Water is to be made to boil by cold. A flask half full of water is maintained at ebullition for some minutes It is removed from the source of heat, corked, inverted, and placed in one of the rings of a retort stand. If cold water is poured on the upturned bottom of the flask the fluid will start into violent ebullition. The upper portion of the flask is filled with steam which maintains a certain pressure on the water. By cooling the upper portion of the flask some of this is condensed, and the pressure reduced. The temperature at which water boils varies with the pressure. When it is reduced water boils at a lower heat. By pouring the cold water over the flask we condense the steam so that the water is hot enough to boil at the reduced pressure. To assert that water boils by the application of cold is a chemical sophism.

It seems paradoxical to see a genuine metal melt in boiling water. It is a general rule that alloys melt at a lower temperature than any of their components. By making an alloy of cadmium, bismuth, lead, and tin, in proper proportions, we form a compound that will melt far below the boiling point of water, or about 160° F. Yet the melting point of tin, the most fusible of the four, is over 450° F. A good way to exhibit this is to make teaspoons or punch ladles of it so that they will melt in the hot fluid. It would be an illustration of the old proverb, "There is many a slip 'twixt the cup and the lip."

Double decompositions are responsible for many of our titular experiments. By mixing solutions of ferric oxide and potassic ferrocyanide we obtain Prussian blue. The solutions may be so diluted as to be colorless. So two colorless solutions produce a colored one, the suspended precipitate coloring the mixture. So may chrome yellow, or lead chromate, and mercuric iodide, and hundreds of other reactions be made to repeat this phenomenon. The acid radicals in these cases change places with each other. By proper succession very pretty effects may be produced. Thus five colorless solutions may be made to produce a colorless, a red, a colorless, a white, and a black mixture, all that is necessary being

to pour from the first vessel into the next, the second into the third, and so on. Numberless other combinations can be made.

To make two colored solutions produce a colorless one we may avail ourselves of the power possessed by nitric acid of bleaching indigo. Two solutions of indigo are made; one contains a good quantity of sulphuric and hydrochloric acids, the other contains potassic or sodic nitrate. On pouring them together and warming a colorless solution results, as the sulphuric acid sets free nitric acide and chlorine, which destroys the indigo.

Two liquids are to produce a solid. This is another double decomposition. Saturated solutions of calcic chloride and potassic carbonate are poured together, when a very heavy precipitate of calcic carbonate or chalk is thrown down. At the present time this seems rather a weak affair, but in its day it was called a chemical miracle. It is for this reason that I show it to you. It is historic.

Two gasses may produce a solid. This is effected by a simple combination. Ammoniacal gas and hydrochloric acid gas are both absolutely gaseous at ordinary temperature and pressure. If brought together they combine, forming a white solid substance called ammonic chloride or sal ammoniac. It is the substance used by tinsmiths to brighten the faces of their soldering bolts before tinning them.

If we immerse the bulbs of two thermometers, one in quicklime and the other in ammonic nitrate, and add water to each, contrary effects are produced. The quicklime has a strong affinity for water, and combines with it eagerly with evolution of much heat. The nitrate of ammonia, on the other hand, without much affinity for water, is very soluble, so it dissolves quickly, and in its passage from the solid to the liquid state renders latent or absorbs a great quantity of heat, causing a fall in the temperature, if rightly managed, of forty degrees. It is a very instructive experiment. To make it really impressive the water should be added from the same flask, so that there can be no fear that water of different temperatures is made to effect the result.

We now come to some phenomena of combustion. As we generally see it, it takes place in the air, which supplies the oxygen. But we can substitute for the oxygen of the air that of a highly oxidized salt such as potassic chlorate. If we mix this with sulphur, which is very combustible, and rub the two in a mortar we get a series of quite violent detonations. By the use of phosphorus instead of sulphur we have a still more violent explosive, which has to be handled with more care. The products of these reactions are primarily sulphurous and sulphuric and phosphoric oxides.

If we mix the same chlorate of potash with a proper proportion of sugar we have a mixture that the touch of a match will ignite and burn with great splendor. The carbon of the sugar unites with the oxygen of the salt. But it is quite unnecessary to use fire to start it. A drop of oil of vitrol or sulphuric acid will start the reaction, so that the deflagration will take place by decomposing the chlorate. Thus we have a solid set on fire by contact with a liquid.

We have already used phosphorus in an experiment which showed its great affinity for oxygen. By boiling it with a strong solution of potassic hydrate a mixed phosphureted hydrogen is set free which is spontaneously combustible. In practice it is made to bubble through water, and each bubble as it bursts produces a flash and spontaneous combustion. In oxygen the explosion is very violent. This gas has a special interest, as the *ignis fatuus* has been explained by it—whether truthfully or not is not certain. It is one of the most beautiful exhibitions of spontaneous combustion in all chemistry. It is susceptible of many modifications.

As a finale I propose to exhibit to you fire under water. We select as two suitable substances phophorus and chlorate of potash. These are placed in the bottom of a flask and water poured over them. To start and maintain the combustion we add sulphuric acid. A highly oxidizing compound is formed, and the phosphorus begins oxidizing or burning with a bright light. To make it more beautiful we can add phosphide of calcium, when, in addition to the white glow of the phosphorus, we have an elegant emerald green glow added to our fire under water. It is not a safe experiment by any means, as there is danger of breaking the vessel by the violent heat caused by the reaction.—*Scientific American.*

PREVENTION OF SMOKE.

At a meeting of the Society of Engineers, held on Monday evening, June 13th, a paper was read by Mr. A. C. Engert on the "Prevention of Smoke."

The author, in choosing the title of the "Prevention of Smoke," instead of the "Consumption of Smoke," gives it as his opinion that smoke, once produced by the atmosphere and while being carried by the air, cannot be consumed, as every particle is surrounded by a thin film of carbonic acid. When, however, smoke is condensed as soot, heat will liberate the carbon from the acid, and then the former will burn rapidly. If this theory is found to be correct, carbon cannot destroy the germs of disease floating in the air.

For the consumption of smoke, many ingenious and elaborate inventions are on record, but not yet adopted on account of expense and complexity of mechanisms. A simpler apparatus is, therefore, required.

To prevent smoke, the cold air must not be allowed to come in contact with the gases arising from green coals, and, for this purpose, the furnace is, so to speak, divided into two parts. The fire-door is removed from the boiler, and a box fixed on in front. On each side of this box rails are placed inside, on which a plate or shutter may rest, which can be pushed forward or backward as required. When pushed forward it passes within the boiler and drops over the fire bars some eighteen inches, thereby cutting off the draft and preventing the condensation of the gases arising when fresh coals are put on, thus preventing smoke and the cooling of the boiler.

A still more simple apparatus can be made with the same results, if the opening or flue will admit a higher box. The shutters can be cast together in one piece at an angle of about 130°, to hang within the box on two pins or bolts, thus forming a swinging shutter. A rack is attached to the front of the shutter to regulate the movement.

The advantages of this apparatus are—the cooling of the boiler is entirely avoided, the gases are consumed so that smoke is prevented, and there is a saving of from 15 to 20 per cent of heat and coal.

In ordinary open fire grates the same object is attained—viz.: the prevention of the cold air from coming into contact with the green coal, by removing the fire lump, and substituting for it a cast-iron box, which stands out on the back and is open in front only, and which is filled with coal. Within this box is a movable iron plate, which can be forced forward, carrying with it the coals from which the gases have been extracted and consumed by the heat in front, or moved backwards when the box wants refilling. To regulate the draught so that the fire burns brightly in front, a plate is fixed under the grate, coming forward at the bottom. Another plate, resting on pins, is placed on the top of the box to prevent the flame entering the register.

By this simple apparatus a bright fire is maintained in front of the grate, half of the heat usually escaping into the chimney is saved, there is little or no smoke, and the smallest coal can be used, and is, indeed, preferable.

In kitcheners, stoves, and vertical boilers, a similar box to foregoing can be fixed, the movable plate being worked by a lever.

This invention is also of great importance to railway companies, as it can easily be applied to locomotives. A box is placed under the foot-plate, the whole width of the fire grate, and the coals put in from the top. By this means the gases are almost entirely drawn out of the coal and consumed, the result being very little, if any, smoke. To supply the grate, the coal is pushed forward by a movable plate and lever.

Whether applied to furnaces, ordinary open fire-grates, stoves, kitcheners, vertical boilers, or locomotives, the results of this invention, in each case, are a great saving of heat and fuel, and the reduction of smoke to a minimum.—*Van Nostrand's Engineering Magazine.*

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, August 13, 1881.

M. Gautier, a distinguished chemist, has discovered that our saliva is toxical and contains a venom identical with that in the saliva of the boa and the viper, the only difference being that of the concentration. In the human saliva, the poisonous substance discovered is neither a virus nor a ferment, but a venom, and its activity cedes in nothing to the most powerful vegetable poisons. M. Pasteur in March, last, on inocculating rabbits with the saliva of sick children, found the animals had contracted a special disease and died. Here the infection was virulent, produced by a virus or special animalcule. The human saliva, in point of toxical intensity, differs, as in the case of serpents. When man is in a passion, the saliva is more poisonous. Deaths are on record produced by the bites of man and animals when in a state of anger. Professor Gautier took three-quarters of an ounce of human saliva, after three hours evaporation in a *bain marie*, the residue was mixed with tepid water and injected under the skin of a bird; the bird became instantly attacked with intense stupor, could not remain standing; in fifty minutes it fell, bill forward, on the ground, and remained in that position during four hours, when it either died or returned slowly to life. The Professor has not been able to isolate the alkaloid in the human saliva, but it acts similarly as the most terrible vegetable alkaloid. But how can we live, swallowing as we do this fearful poison, for the saliva is an essential agent in the digestion of our food— farinaceous substances especially? The venom is equally innocuous with serpents. Some animals, the hedgehog and the pig for example, can eat poisonous serpents with impunity; and it has been shown that the venom itself and the venom-glands, can be swallowed in cases without danger. There is no clear explanation for these facts, but it is believed their virulency is neutralized by the matter secreted by the bile—acting as a counter-poison. But while we can swallow with impunity our saliva, it would be imprudent to inject it under our skins in large quantities. M. Gautier also has discovered the presence of venomous matters in the normal products of the secretions. It thus seems, that all animals fabricate poisons. Dr. Corre, has this year drawn attention to venomous fishes; certain fish in the tropical seas cannot be eaten without producing poisonings. Physiologists have devoted much attention of late to the toxical principles found in bodies in a state of putrefaction; they are alkaloids of extreme virulence following M. Selmi, and may be either fixed or volatile; they are chiefly to be found in the visceræ. How important becomes this subject, if the medico-legal expert cannot distinguish between these self-produced poisons and an alkaloid administered by a criminal hand. The late case of an Italian general is too sig-

nificant. Some experts concluded he was poisoned, while the toxical principles had been ordinarily fabricated by the putrefaction of his remains. Animals then like vegetables, can manufacture poisons.

A distinction must be kept in view between toxical virus, the product of decomposition, and the venom of saliva and serpents. A low temperature will destroy virus, but a trace of virus will, if introduced into the organism, spread with a fearful rapidity. Venom can be submitted to a temperature of 280°, during three hours, and never lose its toxical properties. Besides venoms act in proportion to their weight. Virus is animated, can reproduce and develop itself. Venom is a chemical compound or a poison acting chemically. In poisoning by venom, the muscles never contract under the influence of an electric current. Venom can be boiled, filtered, treated in alcohol, and still retain its toxical quality; its active principle must then be an alkaloid, not a ferment. Professor Gautier has discovered an infallible specific against venom; not tannin, or turpentine or ammonia, but a solution of caustic, potash or soda; hence, the necessity when traveling to have a preparation of either in the pocket medicine-case. When bitten by a serpent, tie instantly the part tightly above the wound, to arrest the circulation of the blood, for in less than half a minute the poison can be conveyed through the whole system; inject the bite next with the solution of potash. Other practical lesson, avoid allowing dogs to lick your hands. In the case of stings of insects, ammonia is efficacious, and if the neck of the bottle be placed over the wound, inflammation will be kept down; the active principle in the venom of a wasp, etc., is acid, and hence, can be dissolved by ammonia. In the venom of serpents, etc., its principle does not dissolve in ammonia, but it is neutralized by caustic, potash and soda.

There are no indications that the mania for undercooked beefsteaks is on the decline; in restaurants, only such are served. This refers to robust people, but weakly persons continue to patronize pounded raw chops and steaks, and the juice of uncooked meat. M. Toussaint exposes the grave dangers of patronizing such a dietary, as, if the meat be unsound, the germs of disease will inevitably pass into the system. He states no contagious malady possesses greater virulence than tubercular affections, or consumption, and that is the form of the disease most to be encountered in meat sent to the market. In the slaughter-houses, an ox, etc., is not rejected as unfit for food, unless the lung be entirely affected, but grey granulations may still exist and produce infection. M. Toussaint took the lung of a cow not at all much affected with consumption; he placed it under a press and collected the juice; he inoculated rabbits and young pigs with the liquid as it came from the press, and after he had heated another portion to 114° F., the result was, all the subjects died within a very short period. He extracted the juice in the same manner from the thigh of a pig, dead from consumption, previously cooking the flesh, to correspond with that served in hotels, etc., according to the latest fashion. Then he inoculated rabbits with such grilled juice, and they also invariably died of consumption. There are cases where the consump-

tion of raw meat is necessary; here duty suggests to ascertain well the origin of such meat; in all other cases it is prudent to only eat meats suitably cooked, that is, meat whose interior has been acted upon by a temperature of 150° or 160°.

The experiments of M. Pasteur are certainly setting not only the scientific world thinking, but acting. By inoculating sheep with the virus specially prepared, of the malady *Charbon*, he rendered them invulnerable to the disease. Veterinary Professor Galtier, of Lyons, has followed up the idea in the case of hydrophobia. He inoculated the veins of sheep with the virus of the madness, and the animals never contracted the disease. In fact, this preventive act has succeeded as ten sheep thus treated escaped the malady, while the ten others not vaccinated, fell victims to the contagion. Can this vaccination be found applicable to dogs, and render them proof against hydrophobia?

The Electricity Exhibition has just opened, but everything is in admired disorder. Several important exhibits have not even yet been installed. The show is thus incomplete for scientific examination. It may be observed, however, that the exhibits are full of promise, and when their efficacity and utility are tested, the progress of electric science must be benefitted. Perhaps opinion is more interested in producing cheap light for domestic purposes, than in any other immediate application of electricity.

The German cavalry are not only being instructed how to destroy railways and telegraphs, but to construct both. In case of war the cavalry would be at once thrown forward in the enemy's country, each soldier is provided with dynamite cartridges; he has only to place one between the rails and sleepers, apply a simple firecord, and the railway is blocked. In the case of the telegraph wires, they do not cut down the posts; that would require too much time, and would render them useless when subsequently the enemy himself might want them; the soldiers have an arrangement by means of which the poles can be easily climbed and the wires cut.

Dr. Bouchardat has published an invaluable work on "Public and Private Hygiene." Not an important every day question but is there examined professionally as well philosophically. His observations on the causes of infant mortality are very interesting. His counsels how to arrive at a reasonable advanced age are practical; he examines ably the delicate questions of consanguinity and prostitution; he deals with the hygiene of each profession; what is special for the soldier, the sailor, the miner, etc. That portion of the work dealing with public hygiene is most valuable; it comprehends all that refers to the soil of large cities, the distribution of gas, pits, sewers, hospitals, schools, private houses, etc., heating, ventilation, epidemics, etc. The Doctor treats the question of the progress of the French population and its connection with the price of food. He shows that if France is behind other nations in the matter of births, she surpasses them in point of average duration of life being longer, that is to say, the mean age of

deaths is greater. At the commencement of the century the average age for th population to arrive at was thirty-one and a half years, the figures now are thirty six years, and this the Doctor attributes to improved sanitary causes and a more scientific knowledge of medicine. However, as there are less births in the country, the infant death rate must be less, and that is very important in striking a general average. Dr. Bertillon has drawn attention to this curious fact, tha where property is very divided, the mortality also is less; on the contrary where property is less divided, there are more deaths, and also more births. In Nor mandy this is not quite exact; in rich Normandy, where proverbially marriage are so largely childless.

METEOROLOGY.

THE WEATHER-PROPHET FARCE.

BY ISAAC P. NOYES, WASHINGTON, D. C.

Probably nothing illustrates the general ignorance of meteorology more tha the faith of the intelligent classes in the great farce of attempting to forecast th weather upon the principle that the weather periodically repeats itself.

When men are carried away by ignorance, it is astonishing how blind the will be to all the facts which oppose their belief and how ready they are t parade before the eyes of the world a few scattering facts which *seem* to substan tiate their theory of belief; whereas, if they were more familiar with the branc of science they would have us join them in, these very scattering and isolate facts would be proof to them of ignorance on the part of anyone attempting suc a thing; and more especially would they condemn it on the part of one holdir a high position in life, a position which could not be held by an ignorant persor that is, ignorant persons are to be excused where blame would and should re upon them if they had had the advantages of education, while for the intellige person there is no such excuse or charity. Intelligence seeks to enlighten— does not attempt to thrive upon ignorance; and if the intelligent person is blinded by some pet idea that he continues to follow the paths of darkness rath than light, so much the worse for him, and the more is he, according to circu stances, to be pitied or condemned.

To speak of prophesying the weather after this manner as a *farce* may d please many good people, yet I simply ask them to put away all bias and look the question from both sides—not to continue to do as they do at present, sa nothing of the many failures of this process, and when something favorable c casionally occurs parade *that* before the eyes of the world as evidence of gre wisdom and complete knowledge of the whole subject. For example, suppo

great knowledge of geography was claimed for some person, and he even claimed for himself that he was in this branch of knowledge superior to the rest of the world, and he was asked some ten or a dozen questions as to the location of places, etc., and he should answer only two or three correctly and then the public should shut their ears to his mistakes but praise him generally, and give him great credit for the few right answers, and by their words imply that he knew it all and better than anyone else. Would it not seem absurd? Yes, it would, because we as a people understand geography pretty well, but when it comes to the weather even the intelligent world is surprisingly ignorant, and this ignorance shuts our eyes to a multitude of errors and makes us grasp a few points of seeming wisdom as the fullness of wisdom itself.

When a man willingly takes a stand before the world and lets it be understood, and even claims for himself, that his wisdom in a certain line is superior to the rest of mankind he must expect to have his work weighed in the balance, and if found wanting, to be condemned and rejected.

It is astonishing that so few people of intelligence have considered it worth their while to study the beautiful yet simple laws which go to make up our weather system.

Although it is claimed that the "Great Canadian Weather Prophet" is a wise man, he has not thus far given the world one new idea in regard to the weather; indeed, any knowledge of the laws of storms, any information as to the changes of the seasons, from heat to cold and cold to heat, would only tend to reveal the fact that the system based upon the idea of weather periodically repeating itself, and weather prophecies based thereon are of no value. But we often hear it said "He *hit* it this time." If any intelligent person will study the weather map every day, even for a month, and note the changes, following them up day after day they will, I think, see the great absurdity of the idea of "hitting it." Knowledge on a subject like this is not like firing at a mark.

The changes of the weather follow certain fixed laws and are the result of certain combinations of forces. These forces do not follow in fixed grooves. In this respect nature much resembles a kaleidoscope and is as endless in her varieties of storm and sunshine as in the varied forms of her clouds; and I am thinking that when we can carry our mathematics to such an extent that we can calculate the changes of form and color in the kaleidoscope *in advance* we can then hope to calculate with certainty the exact changes of nature in advance; until then we must be satisfied to take the weather as we find it revealed on the daily map. As often explained in these papers we can with considerable certainty forecast the weather from three to four days in advance, *i. e.* from one change to another (from one "Low" to another). We cannot do any more and we cannot always do this. The length of time ahead depends upon the changes made by nature.

During midsummer it is more difficult to say when there will be a storm than during the spring months, for the reason that the storm-centers, or "Low" so continually travel on such a high line of latitude, and there is often so little

moisture in it—being dissipated by heat—that it is very uncertain when an where it will precipitate, while during the spring months the storms traveling o a lower line, and passing on an average of about a four days' period it is muc easier to predict rain and to make a schedule of time for storms which, to th ignorant, may seem very wonderful. But after all even during the spring montl there is no more certainty that a storm-center will follow in the exact line of th one that preceded it than during mid-summer. The line of the storm-centers c this year are not like those of last year or of any preceding year. It is simpl impossible for any great degree of similarity in this respect.

Probably nothing tells so much for or against a person as their own word: and every person who puts his thoughts upon the printed page should be willing t abide by them. If he is in the right fair quotations therefrom cannot hurt him while if he be in error, there can be no stronger proof brought to bear again him.

In his almanac Mr. Vennor says that "July bids fair to be excessively ho and tempestuous, the hottest days probably being the 4th, 5th 9th, 11th, 16tl 17th, and the 25th and 26th. Thunder and lightning storms are likely to occu in many localities, on the 1st, 5th, 8th, 9th, 15th, 17th or 18th, 27th or 29tl Should frosts occur during the month the 13th, 21st, 23d and 31st are likely dat for such. The month will probably terminate with cool evenings and nights.

In this statement localities are not mentioned; no reasonable localities, sa western, middle or eastern sections of the United States and Canada, and y one who knows anything about the weather system of the globe, well knows th all of the above weather might happen in one section and not in another; for e ample from the 17th to 18th of August it was reported very hot in the northwes yet it was not hot in the eastern portions of the country, indeed it was the whil getting cool and on the 19th it was quite cool for summer weather. The reaso for this was that the new "low" of the 16th started in the northwest, making hot there, but this "low" did not, for some reason unknown to us, continue c a high line, but as it advanced eastward took a southeast course making it qui cool in the northeast. It passed the locality of Washington without any preci tation, and then followed the line of the coast in a northerly direction—on th 20th centering off the coast of New England and again making the eastern po tion of the United States very warm.

Not satisfied with the statement in his almanac, during the latter part of Ju Mr. Vennor issues *another* statement, wherein we were to have heavy rains fro the 20th to the 22nd of July in New York and vicinity. Between the 10th a 15th an exceedingly hot term. Well it was hot generally throughout the count on these days, but it was also as hot almost from the very first of July and rig along until the 18th, when for reasons most beautifully revealed on the weath map it was a little cooler. But Mr. Vennor made no mention of this in *any his statements for July*. He did say, however, "within a few days from the clo of the month, probably about the 27th or 28th, a cool wave will occur." Becau we had the cooler weather about the 18th, it was a common thing to hear ign

t people claiming it for Mr. Vennor. When confronted with the "weather ophet's" own statements the few fair-minded ones admitted that it was not just so" and that he was a little "off" this time. Again, on the 21st of July, r. Vennor appears with a supplement for the last half of the month, wherein the th was to be hot and windy; 25th oppressive and stormy; 26th and 28th cloudy, ol weather, with cool nights and cool showers; 29th cool and showery; 30th d 31st warm weather, high winds and rain showers."

The 24th was not hot and windy, the 25th was warm but not "oppressive d stormy." We did not have a heavy rain storm and winds on the 26th. The st of the month was very even, neither hot nor cold. On the 30th the barom-er was highest in the northeast with an extended area of "high" generally over e United States while an area of "low barometer" was appearing in the north-est.

So much for July. For August no better success attended these efforts, at ast up to the time of writing this article. In his almanac for August Mr. Ven-r says, "August, in striking contrast to the same month in 1880, looks decid-ly moist, and will probably resemble that of 1877 in Canada and the United ates. The month will enter warm, but cooler, and rather unseasonable weath- may occur on the 4th and 5th, after which sultry and stormy weather will again in. Thunder and lightning and hail storms are likely to cause considerable mage over wide spread areas both in Canada and the United States, especially western sections, and the month again promises to resemble that of the year 77."

His after statement in the daily papers is as follows: "1st, probably warm d oppressive; 2nd—5th generally pleasant weather with fairly warm days and ol to cold days, and fall-like evenings and nights; 6th fair and pleasant; 7th nday, heat and storms; 8th and 9th sultry weather with heavy showers, cooler enings and nights; 10th ditto; 11th—13th heat again in the United States, h cloudy and sultry weather, with storms in Canada; 14th Sunday, cooler—ange; 15th cooler to cold and cloudy and pleasant; 16th storms in Virginia; 17th d 18th hail storms, and frosts probably in some sections; 19th heat and storms; h ditto; 21st Sunday, sultry and showery; 22nd sultry and windy; 23rd heat and nd; 24th ditto; 25th and 26th heavy storms on the lakes, St. Lawrence and w York; 28th and 29th cooler weather with rains and frosts in northern sec-ns; 30th and 31st fair and pleasant with cool evenings and nights with indica-ns of returning heat."

Up to the time of writing (August 22nd), this has certainly not been a wet nth; on the contrary it has been a very dry month, and if one will take the uble to refer to the weather map he or she will see not only what kind of ather we had here at the National Capitol, but what they had all over the ntry, and they will also see that any intelligent person with a knowledge of gust weather in this country could have written out as good a probabilities as weather prophet of this or any other country. The month began with "low" he northwest, making it hot. On the 2nd there was a "low" in the Gulf,

but on account of a new "low" starting in the northwest it did not cool much but continued hot, although the chances were that but for this southern "low" it would have been much hotter throughout the country. The southern "low" neutralized the heat of the northern one. So long as "low" was on a high line it continued hot up to the 7th. On the 6th a "low" appeared in the southwest but it was not of sufficient power to create any very great change. On the 7th the extended "low" in the northwest overpowered the influence of the one in the south. On the 7th however it was somewhat cooler. The southern "low" neutralized the heat created by those of the north, and those of the north neutralized the cold which would have been developed by those of the south had they been the only ones present in the country. 8th, 9th and 10th "low" traveled on a high line again, by the 10th making it quite hot, and this notwithstanding "low" in the south. By the 11th the southern "low" had worked along the coast up as far as Cape Hatteras, neutralizing the influence of the northern "lows." But this "low" as it worked along the coast to the north took the heat of the south with it and added it to the heat already present in the north the result of which was a very hot day on Saturday the 13th. Sunday the 14th it was still hot and pleasant, a "high" advancing from the west kept it a little cool and pleasant so the 15th of August was about as fine a summer day as one could wish to see, "high" being quite extensive over the northern portions of the United States.

On the 16th Mr. Vennor was to have "storms throughout portions of Virginia." But as we cannot have storms without a storm center, and as there was no storm center within a thousand miles of this locality there was no show for storms in Virginia, nor did they have any in that neighborhood until the 18th when the storm center advanced to that locality, passing it from the 19th to the 20th. Because of what Mr. Vennor said of the weather for the 14th—18th inclusive many of his friends are very ready to claim for him the cool weather in the east and north from the 17th—19th inclusive. Had the *other* conditions followed and the *whole thing* been complete with the *storms in Virginia on the 16th*, with "hail storms and frosts probably in some sections," on the 17th and 18th, then there might have been some reason in such a claim, but as it is it seems very absurd to make selections in such matters—indeed, it is too foolish and too much of a farce for intelligent people to heed. What must the people of the northwest think of this when it was very hot in their section from the 17th to the 18th. It was simply cool in the eastern sections of the country on account of the peculiar relations of "high" and "low." One glance at the weather map for these days explains it all. It is useless and profitless to follow up these daily records forever in order to prove that "John Smith" has not proved a good prophet. Already sufficient facts have been cited to show the absurdity of the attempts at forecasting the weather on the basis of the weather periodically repeating itself. That some "prophet" may "hit it" sometimes is no wonder at all—others can do as well—and one intelligent person may know as much about it as another.

In these papers criticism has been a secondary feature. Mere criticism is of very little account. Unless a man can do more than that he had better not say anything. In all of these papers the attempt has been to instruct, to throw light upon a subject of great interest, which from peculiar circumstances—want of general facts—long remained in darkness. Criticism of the "weather prophet" system has only been introduced as auxillary to this instruction. In the past such a system, if it may be so honored, was excusable, but its days are past and any further continuation of this "system" is the merest farce, too simple for intelligent persons to regard with the least favor. It is not to be depended upon; is not reliable and is generally unworthy of the attention of intelligent people.

WASHINGTON, D. C., August 22, 1881.

PORTABLE METEOROLOGICAL STATION.

Under this name is designated an instrument especially adapted for the use of travelers in mountain excursions in order that they may be able to observe and accurately register the different atmospheric phenomena they experience, and so fill the gap that generally exists in the history of Alpine and other ascensions.

This instrument is so arranged that it can, in any place, conveniently and exactly determine the most important meteorological phenomena, the pressure and temperature of the air, and its degree of humidity. It is a combination of a barometer, thermometer, hygrometer, and compass, arranged in a small case that can easily be carried, as it weighs one kilogramme.

The different parts are so perfectly balanced that the instrument can be used in any position and can stand, without injury, the rough usage of mountain traveling.

The barometer is the aneroid, a well-known instrument, and is especially adapted to show the pressure of the atmosphere, and the elevation of the place of observation above the sea level.

The temperature is shown by a mercurial thermometer, fixed on a copper tube, that forms a general support for the whole apparatus. The thermometer registers the centigrade system from 25° below zero to 40° above.

The degree of humidity in the atmosphere is determined by a Saussure hair hygrometer, which is slightly modified in this apparatus. A well constructed hair hygrometer gives results sufficiently accurate for general meteorological observations, as the hairs work regularly, and their small bulk causes them to be easily affected by the surrounding air, which is a great advantage when there are only a few moments to make an observation.

This hygrometer is the only one available for those altitudes where the temperature is below zero, and where, consequently, neither the psychrometer nor the condensing hygrometer could be used.

Another advantage is that it shows immediately the degree of humidity, for a table, inscribed on the semi-circumference of the circle, gives in a moment the equivalent of the degrees of the hygrometer in the fractions of saturation of the air.

By this method we can make most interesting comparisons of the humidity of the fogs and mists that are encountered on the mountains and in the vicinity of elevated lakes.

It is easy to see the utility of the compass, which shows the position of the country, and is especially useful to the traveler, when exploring an unknown place or surrounded by a heavy fog. The direction of the wind can also be easily ascertained by tying a piece of ribbon to the ring at the top of the instrument, and so making it still more useful.—*La Nature.*

TREE CULTURE ON WASTE LAND.

Hitherto the abundance of natural timber in this country has made it easy to dispense with timber culture, and for the most part our land owners have taken little interest in such slow-growing crops. This state of things, however, is rapidly passing away. The demand for special woods for manufacturing purposes is steadily and rapidly increasing, while the natural supply is diminishing, and must ultimately become quite inadequate. Meantime there are millions of acres of land suitable for timber culture and for nothing else, except poor pasturage that our land owners are allowing to lie waste and idle for lack of a little forethought, and too frequently our would-be thrift farmers will risk their surplus means in wild-cat speculations, promising, but never yielding, large and speedy returns, when the same money, spent in planting timber, would soon convert their worthless swamps and stony places into valuable properties.

A correspondent of the *Scientific News*, writing from Wisconsin, tells of a piece of land that was planted with walnut twenty-three years ago. The land was flooded every spring and summer, and was unfit for ordinary cultivation. The trees are now from 16 to 20 inches through, and have been sold for $27,000. No particulars have been given as to the cost of planting the grove, or the amount of attention it has had during the years of growth. There can be little doubt, however, that the investment was small in comparison with the return, and the land would otherwise have remained entirely unproductive. To the country the timber crop was so much clear gain. It is clear that our national resources might be enormously increased by a similar utilization by timber culture of lands which are now left unused and unproductive; and the planters would find their groves a surer investment for the security of their family possessions than any savings bank deposit.

EXTENDING THE UTILITY OF THE SIGNAL SERVICE.

The suggestion has been made to extend the utility of our already very efficient Signal Service by adding to its scientific labors the work of making systematic observations respecting the electrical condition of the atmosphere. The proposal is that these observations shall be made, as meteorological observations are now made, simultaneously by a large number of competent observers over large areas, in order that the general laws respecting the connection of the electrical state of the atmosphere with meteorological conditions—which connection is known to exist, but is very imperfectly understood—may be worked out and formulated. It is known, for example, that the prevalence of certain winds along our coasts is usually accompanied by peculiar electrical states of the air; and the coming of these winds can be predicted, even in the present imperfect state of our knowledge, by observations on the electrical state of the air. With respect again to thunder-storms, it has long been known that their advent is almost invariably preceded by pronounced electrical disturbance, which could frequently, if not always, be recorded upon delicate electrical apparatus, with a clear sky and sunshine above.

The important practical bearing of these facts upon the meteorological work now being carried on so successfully by our Signal Service observers is too obvious to require explanation. The great progress in meteorology that has been made during the past decade, has been almost entirely due to the adoption of the plan of making systematic and simultaneous observations over very extended areas; and the little that we at present know of the relation subsisting between the electrical state of the atmosphere and meteorological phenomena, is sufficiently suggestive to justify the opinion that highly important scientific and practical results would follow the establishment of electrical observing stations in connection with those of the Signal Service.

The suggestion of extending the operations of the Signal Service by incorporating a system of electrical observations into the routine work of its numerous observers, has frequently been mooted by scientific men and discussed at scientific gatherings. While the great interest and almost certainty of valuable practical utility that would result from this extension of the work of the Signal Service has been universally admitted, no steps have as yet been taken on the part of the government to put the idea into practical shape. The proposed extension of the duties of the Signal Service would entail a large increase in the annual expenditure of the corps; and it is plausibly argued that the government would not be justified in incurring this yearly addition to its expenditures until the utility of the new scientific observations to commerce and agriculture shall have been demonstrated. In view of the very strong probability, in the light of our present imperfect acquaintance with this interesting subject that great benefits would result from the new departure, the argument just stated appears to be exceedingly weak; but happilv a way has been found out of the difficulty which promises to

solve it and to place the difficulty which promises to solve it and to place the subject of electrical observations before the government authorities in such shape at an early date, as to command their attention and support. The plan in question is embraced in a recent proposal that a number of our leading scientific institutions shall coöperate with the Signal Service in putting this work into practical shape, and thus test its utility. The plan has, we believe, been very favorably considered, and we may hope to see it in practical operation at an early date.

Prof. John Trowbridge, of Harvard University, who has taken great interest in the subject, has written a very interesting account of the proposed plan of coöperation, from which we glean the following facts. He says:

"Since our knowledge of meteorological phenomena depends upon simultaneous observations extended over large areas, a number of stations for observing the electrical state of the air should be established in connection with the Signal Service. The practical difficulties, however, in establishing such stations are great. Each station would require an original outlay of not far from $1,000, and the salary of an observer must make part of the yearly expense of the station. This observer must be an experienced man, of a higher grade than the assistants in an ordinary meteorological station. In view of the large expense for equipping and maintaining such electrical stations, it is not probable that the Signal Service will establish them until it has been shown that the observations from such stations possess great importance to commerce and agriculture.

"By a simple plan of coöperation with the Signal Service, Harvard University, Yale, Columbia and Princeton Colleges, the University of Pennsylvania and the John Hopkins University could enable the United States Government to try the experiment of establishing electrical stations with the minimum of expense. The expense of erecting suitable buildings and of providing experienced observers, could be greatly diminished if each institution would furnish observers and suitable rooms. These institutions form a cordon of nearly a thousand miles along the Atlantic coast where commerce is most active. It is probable that they would be relieved of the routine work necessary for simultaneous observations on the electrical state of the air, when it had been shown that such observations are valuable from a commercial point of view; for as soon as the universities have performed their high function of leading in scientific inquiry, and the results affect the daily pursuits of mankind, new observations in meteorology, which require special scientific inquiry in physical laboratories, should lead the Signal Service to again extend its observations."—*The Manufacturer and Builder.*

ASTRONOMY.

ASTRONOMICAL NOTES FOR OCTOBER, 1881.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.	Declination S.	Diameter.
1st.	12h. 31m. 46s.	3° 25′	32′ 03.3″
15th.	13 23 11	8 45	32 11.02
31th.	14 24 15	14 19	32 19.48

Sidereal time of mean noon on the 1st 12h. 42m. 27.49s; on the 31st 14h. 40m. 44.09s. Equation of time for apparent noon, 1st 10m. 30s; 31st 16m. 18s Equation of time is used to avoid the irregularity which would arise from using the true sun as the measure of time, a fictitious sun, called a *Mean Sun*, is supposed to move in the equator with a uniform velocity. This mean sun is supposed to keep, on the average, as near the real sun as is consistent with perfect uniformity of motion; it is sometimes in advance of it, and sometimes behind it, the greatest deviation being 16m. 18s.

THE MOON.

Date.	Right Ascension.	Declination S.	Semi-diameter.
1st.	19h. 28m.	18° 37′	16′ 13″
5th.	23 11	00 16 N.	16 22
10th.	3 46	20 55	15 30
15th.	8 07	16 09	14 48
20th.	11 55	4 44 S.	15 09
25th.	16 17	21 38	15 51
31st.	22 01	6 36	16 11

The most favorable time for making telescopic observations will be from the 12th to the 16th and from the 27th to the end of the month. It reaches perigee on the 4th, apogee on the 16th and returns to perigee on the 31st.

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage.
1st.	13h. 49m.	12° 47′	1h. 07m. P. M.
5th.	14 09	15 05	1 11
10th.	14 33	17 36	1 15
15th.	14 54	19 40	1 17
20th.	15 12	21 06	1 15
25th.	15 24	21 43	1 07
31st.	15 22	20 48	0 41

On the 16th it reaches greatest its elongation east of the sun 24° 43′. Its apparent diameter on the 1st is 5.5″ and on the 31st 8.9″.

VENUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	10h. 28m.	10° 34′	9h. 47m. A. M.
5th.	10 46	8 55	9 49
10th.	11 09	6 45	9 52
15th.	11 32	4 29	9 55
20th.	11 55	2 09	9 58
25th.	12 17	0 12 S	10 02
31st.	12 45	3 04	10 05

She will be to the west of the sun during the entire month, and in a favorable position for morning observation. The apparent diameter is slowly decreasing on the 15th it is 12.4″.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	6h. 15m.	23° 32′	5h. 32m. A. M.
10th.	6 31	23 38	5 12
20th.	6 47	23 43	4 48
31st.	7 00	23 51	4 17

The apparent diameter on 15th is 11.1″ and is slowly increasing. It will rise on the 1st at 10h. 09m. P. M., and on the 31st at 8h. 55m. P. M.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	3h. 34m.	18° 02′	2h. 50m. A. M.
10th.	3 32	17 52	2 12
20th.	3 28	17 37	1 28
31st.	3 23	17 18	0 40

Phenomena presented by its four satellites. The time used being Kansas City, M. S. T.

DATE.			PHENOMENA.
1st,	9:27 p. m.	Europa,	Sh. In.
	11:28 p. m.	Europa,	Tr. In.
2d,	0:04 a. m.	Europa,	Sh. Eg.
	10:39 p. m.	Ganymede,	Ec. Dis.
3d,	0:12 a. m.	Ganymede,	Ec. Re.
	2:46 a. m.	Ganymede,	Oc. Dis.
	3:56 a. m.	Ganymede,	Oc. Re.
	9:03 p. m.	Europa,	Oc. Re.
4th,	1:32 a. m.	Io,	Sh. In.
	2:29 a. m.	Io,	Tr. In.
4th,	3:44 a. m.	Io,	Sh. Eg.
	4:40 a. m.	Io,	Tr. Eg.
	10:41 p. m.	Io,	Ec. Dis.
5th,	1:47 a. m.	Io,	Oc. Re.
	8:00 p. m.	Io,	Sh. In.
	8:55 p. m.	Io,	Tr. In.
	10:12 p. m.	Io,	Sh. Eg.
	11:06 p. m.	Io,	Tr. Eg.
6th,	8:13 p. m.	Io,	Oc. Re.
9th,	0:03 a. m.	Europa,	Sh. In.

DATE.		PHENOMENA.		DATE.		PHENOMENA.	
9th,	1:48 a. m.	Europa,	Tr. In.	20th,	10:36 p. m.	Ganymede,	Sh. Eg.
	2:40 a. m.	Europa,	Sh. Eg.		11:30 p. m.	Ganymede,	Tr. In.
	4:20 a. m.	Europa,	Tr. Eg.		11:44 p. m.	Io,	Oc. Re.
10th,	2:40 a. m.	Ganymede,	Ec. Dis.	21st,	0:40 a. m.	Ganymede,	Tr. Eg.
	4:13 a. m.	Ganymede,	Ec. Re.		6:52 p. m.	Io,	Tr. In.
	7:12 p. m.	Europa,	Ec. Dis.		8:29 p. m.	Io,	Sh. Eg.
	11:22 p. m.	Europa,	Oc. Re		9:02 p. m.	Io,	Tr. Eg.
11th,	3:26 a. m.	Io,	Sh. In.	22d,	6:10 p. m.	Io,	Oc. Re.
	4:15 a. m.	Io,	Tr. In.	25th,	0:22 a. m.	Europa,	Ec. Dis.
12th,	0:35 a. m.	Io,	Ec. Dis.		3:54 a. m.	Europa,	Oc. Re.
	9:45 p. m.	Io,	Sh. In.	26th,	4:33 a. m.	Io,	Ec. Dis.
	10:41 p. m.	Io,	Tr. In.		6:35 p. m.	Europa,	Sh. In.
13th,	0:07 a. m.	Io,	Sh. Eg.		7:31 p. m.	Europa,	Tr. In.
	0:52 a m.	Io,	Tr. Eg.		9:12 p. m.	Europa,	Sh. Eg.
	7:04 p. m.	Io,	Ec. Dis.		10:04 p. m.	Europa,	Tr. Eg.
	8:09 p. m.	Ganymede,	Tr. In.	27th,	1:43 a m.	Io,	Sh. In.
	9:18 p. m.	Ganymede,	Tr. Eg.		2:10 a. m.	Io,	Tr. In.
	9:59 p. m.	Io,	Oc Re.		3:54 a. m.	Io,	Sh. Eg.
14th,	7:18 p. m.	Io,	Tr. Eg.		4:20 a. m.	Io,	Tr. Eg.
16th,	2:40 a m.	Europa,	Sh. In.		10:53 p. m.	Io,	Eg. Dis.
	4:06 a. m.	Europa,	Tr. In.	28th,	00:47 a. m.	Ganymede,	Sh. In.
	5:17 a. m.	Europa,	Sh. Eg.		1:28 a. m.	Io,	Oc. Re.
17th,	9 47 p. m.	Europa,	Ec. Dis.		2:36 a. m.	Ganymede,	Sh. Eg.
18th,	1:39 a. m.	Europa,	Oc. Re.		2:48 a. m.	Ganymede,	Tr. In.
19th,	2:30 a. m.	Io,	Ec. Dis.		3:58 a. m.	Ganymede,	Tr. Eg.
	5:18 a. m.	Io,	Oc. Re.		8:11 p. m.	Io,	Sh. In.
	6:35 p. m.	Europa,	Sh. Eg.		8:35 p. m.	Io,	Tr. In.
	7:48 p. m.	Europa,	Tr. Eg.		10:23 p. m.	Io,	Sh. Eg.
	11:48 p. m.	Io,	Sh. In.		10:46 p. m.	Io,	Tr. Eg.
20th,	0:26 a. m.	Io,	Tr. In.	29th,	7:54 p. m.	Io,	Oc. Re.
	2:00 a. m.	Io,	Sh. Eg.	31st,	5:25 p. m.	Ganymede,	Oc. Re.
	2:36 a. m.	Io,	Tr. Eg.	32d,	2:58 a. m.	Europa,	Ec. Dis.
	8:46 p. m.	Ganymede,	Sh. In.		6:08 a. m.	Europa,	Oc. Re.
	8:59 p. m.	Io,	Ec. Dis.				

In. denotes ingress; Eg. egress; Dis. disappearance; Re. reappearance; Ec. eclipse; Oc. occultation; Tr. transit of the satellite; Sh. transit of the shadow.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 38m.	12° 41′	1h. 54m. A. M.
10th.	2 36	12 29	1 16
20th.	2 33	12 15	0 33
31st.	2 29	11 58	11 47 P. M.

THE APPARENT ELEMENTS OF THE RING.

Outer major axis 45″, minor 15″. Inclination of northern semi-minor axis to circle of declination from north to east 22′. The elevation of the earth above the plane of the ring 19° 35′, elevation of the sun 18° 58′. Earth's longitude from Saturn counted on plane of ring from the ring's ascending node on equator 92° 58′, ecliptic 50° 13′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	11h. 9m.	6° 19′	10h. 22m. A. M.
31st.	11 14	5 43	8 34

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 56m.	14° 55′	2h. 12m. A. M.
31st.	2 53	14 41	0 11

PHENOMENA.

On the 9th at 7:36 A. M., conjunction of Saturn and the Moon. Saturn south 5° 19′.

On the 9th at 4:00 P. M., conjunction of Neptune and the Moon. Neptune south 3° 59′.

On the 10th at 3:00 P. M., conjunction of Uranus and Venus. Venus north 0° 32′.

On the 13th at 5:45 P. M., conjunction of Mars and the Moon. Mars north 2° 56′.

On the 16th at 8:00 A. M., Mercury's greatest elongation, east 45° 43′.

On the 19th at 3:07 P. M., conjunction of Uranus and the Moon. Uranus north 6° 19′.

On the 20th at 2:00 P. M., conjunction of Venus and the Moon. Venus north 6° 48′.

On the 24th at 3:05 P. M., conjunction of Mercury and the Moon. Mercury south 1° 19′.

On the 27th, Mercury stationary in righ ascension.

On the 31st at 11:00 A. M., opposition of Saturn and the Sun.

The Moon makes 17 occultations during the month. 2 on the 3d, 1 on the 4th, 4 on the 5th, 1 on the 9th, 3 on the 10th, 3 on the 11th, 1 on the 18th, 29th and 31st.

AN UNUSUAL AND STARTLING CELESTIAL PHENOMENON.

Shortly after sunset, Monday, September 12th, the attention of people upon the streets was drawn to one of the most singular displays in the heavens ever witnessed. Directly overhead, as far as the view was unbroken by buildings, appeared a clearly defined belt of light, almost milk white, and apparently about twelve degrees in width. The view of the phenomenon from the street was, of course, greatly obstructed, and the excitement was so great that the tops of buildings were soon well filled by wildly-speculating, and in many instances, frightened citizens. Following closely as the phenomenon did upon the peculiar atmospheric disturbance of a week ago, it gave rise to apprehension in the minds of many who, under ordinary circumstances, would have looked upon it only with surprise. Viewed from an eminence, the apparition presented a wonderful spectacle. From the eastern horizon to the western, it stretched in an unbroken line, its edges as definite as those of a gayly-colored ribbon. Although it was as white as pure smoke sometimes appears, it had a peculiar life-like appearance that smoke never has, and seemed to emit a ghostly light. No two persons who viewed it seemed to have the same idea in regard to it. One man with whom a reporter talked, asserted that he had witnessed something almost like it just before the war; another—an old gray-haired man—gazed at it in wonder, and said that he had never seen anything to be compared with it; a third thought it was the tail of one of the many comets that have appeared of late, while a fourth asserted that it was an aurora. Determined to fathom the mystery, if possible, an *Argus* reporter hastened toward the Dudley Observatory at about 8:30 o'clock, when the phenomenon had almost disappeared. As he climbed the hill leading to that institution, the only traces of the apparition that remained were directly overhead, and formed two sides of a triangle, the point seeming to be in the zenith. By the time he reached the observatory all traces had disappeared. Prof. Boss was unfortunately found to be out of the city. In answer to the reporter's ring at the door, one of the professor's assistants appeared. He wore an excited look, and upon being interrogated it was found that he had completed an observation of the phenomenon.

"At eight o'clock I first saw it, and its effect was absolutely startling. It spanned the heavens from east to west, and seemed of very nearly equal breadth the whole distance. It was sharply defined. At its southern edge it extended from the horizon through Zeta and Delta Bootes; thence through Nu Pi Hercules, to and through Alpha Lyra. From that point it extended to the south of the Great Square in Pegasus. The northern branch in the east extended up through the head of Draco, and there seemed to be a strong ray of light, very marked, continuing from Gamma Bootes, while around to the north there were several

parallel streaks inclined at an angle of fifty degrees, with the general motion of the phenomenon. Three or four of these were noticed near the head of Draco. At 8:30 it was observed to clear away on the zenith. The eastern portion now consisted of a narrow strip, very bright, clearly marked at the edges, extending from Gamma Pisces through Alpha Lyra, and at the same time seeming to be moving southwest, it being about thirty degrees from the zenith and appearing to roll like columns of smoke spirally towards the west. At 8:33, in the east were two parallel streaks, the northern, the heavier and the southern throwing out diverging lines of light that seemed to gradually curve as they approached the zenith. At 8:35 o'clock the main branches separated at the zenith, while the western one was very narrow, extending through the Northern Crown. A small line of light now extended from a point about three degrees north of Alpha Lyra to a point about seven degrees from Ela Ursa Major. At 8:39 a brighter streak appeared between Alpha Lyra and Ursa Major, while that over the Crown was broken up into a series of parallel, smaller and fainter streaks. The eastern branch was now very faint and narrow, and extended nearly from Pi Pisces to Alpha Lyra, while all along the northern horizon was a bright rosy glow like the northern lights, but brightest towards the west. At 8:45 the phenomenon presented a faint, yet beautiful appearance, and at 8:55 it had vanished."

"I have not the courage to make any assertion in the matter. It may have been an aurora, but so far as my knowledge goes, it was something unique."

Manager Uline, of the telephone exchange, says that it was not an aurora, as during an aurora the telephone wires exhibit a disturbance, while on the night aforesaid they worked all right. In the name of this wonderfully-marked year, what was it? Similar phenomena were observed at Utica, N. Y., Boston, Mass., and Hanover, N. H.—*The Argus, Albany, N. Y.*

PHILOSOPHY.

CREATIONAL PROGRESS.

BY PROF. H. A. REID, SEC'Y STATE ACADEMY OF SCIENCES AT DES MOINES, IOWA.

The very nature and constitution of the human mind is such, that no man can talk or even think about his own existence and that of the visible world of objects around him, without *assuming*, even though he may deny it in words, the idea and the fact of a Great First Cause—or, as Herbert Spencer now phrases it, "the inscrutable universal power." I, therefore, maintain that *a real atheist* is a phenomenal impossibility; the *existence of God* is simply an eternal fact—but men's ideas *about God* are various and changeful. Then, without attempting to

define how, what, or where God is, I assume the general fact to be an eternal fact; and therefore the "laws of nature," so-called, are simply *the mode* of God's direct and directing energies in creation and providence. A few of those laws of nature man has already learned something about; vastly more of them still "move in a mysterious way, their wonders to perform;" but none of God's laws are too secret or too sacred for man's reverent and most searching inquiry.

I next present the Synoptic Calendar of Creation, which is a companion piece to the Psychic Calendar, given in the REVIEW of September, page 264, and also of the Zoic Calendar, given in the REVIEW for July, page 138. The object of these calendars is to show in a plain, perspicuous, and easily comprehended way, how naturally the discoveries, the deductions and the logical sequences of modern science do supplement and confirm what has been *revealed* in the Hebrew and Christian Bible for thousands of years.

THE SYNOPTIC CALENDAR OF CREATION.

Calendar to be read from the bottom upward.

THE SPIRITUAL *KINGDOM.*	God, angels, "ministering spirits," and "the spiritual man" of the Bible—that is, those endowed with that faculty or spiritual sense (the "sixth sense" of my Psychic Calendar) whereby they discern God as a spirit, and "worship him in spirit and in truth."
THE ANIMAL *KINGDOM.*	All forms and conditions of animal tissue or animal product, including animal man, or "the carnal man" of the Bible.
THE VEGETABLE *KINGDOM.*	All vegetable growths, substances and products.
THE MINERAL *KINGDOM.*	Every solid and fluvial substance that is not or has not been a vitalized part of any vivific structure.
THE ELEMENTAL *KINGDOM.*	Preterrestrial elements, or nebulous and gasiform matter which ultimately condensed and formed the gaseous, fluviatile and solid substances composing our world.

The above schedule, followed from the bottom upward, shows the order of creational progress, each "kingdom" being evolved or created out of not only the last preceding one, but doubtless in some measure from all the preceding—not that "the spiritual kingdom" is thus produced, in all that it comprehends, but that the "spiritual man," after he has become cognizant of God and spiritual things, still dwells in the flesh for a time, and is therefore a "connecting link" between the animal kingdom and the spiritual kingdom*; or, the animal form of man walking the earth, but the angel consciousness more or less developed within his soul. This is the natural philosophy of that sentiment,

"I want to be an angel, and with the angels stand,"

and others like it, so common in our church and Sunday school hymn books.

* See a very remarkable article bearing on this subject, written by Rev. F. H. Hedge, D. D., of Harvard University, and entitled "Ghost Seeing," in the *North American Review* for September, 1881.

Thus, modern science and the doctrine of evolution cast in their evidence to authenticate and confirm as good and true, because reaching in the direction of creational progress, that rich element in our Christian hymnology.

I next present the "Mosaic Calendar of Creation," day by day, with the correlative facts of creational progress as taught by modern science:

THE MOSAIC CALENDAR OF CREATION.

Creational periods or epochs as given in the first chapter of Genesis; and the corresponding eras and facts in evolution, as taught by modern science.

By H. A. Reid, *Sec'y Iowa State Academy of Sciences*

To illustrate his lectures on "Evolution," "Science and the Bible," etc., approved and commended by the State Executive Committee of the Young Men's Christian Associations of Iowa.

☞ Take your Bible and trace the record through.

"In the beginning.' *Verse* 1-2	Primeval chaos, or the cosmical-nebula condition of the matter which now composes our solar system. [Infinite space already flecked with other nebulæ and systems of worlds.]
1st Day. *Verse* 3 *to* 5	Nucleal rotation, by which light and darkness (cosmical light), were differentiated in our nebulous mass,-first in the whole mass of our solar system, and subsequently in each planetary mass in its turn.
2nd Day. *Verse* 6 *to* 8	A fire crust is formed, with hot, seething, fuming waters upon it, then an interspace or "firmament" of superheated air, then a thick, black sea of vapor or cloud-waters above.
3rd Day. *Ver.* 9 *to* 13	The cooling globe contracts, thus forming wrinkles in its crust; then the depressions become seas and the elevations dry land, and vegetation begins to appear.
4th Day. *Ver.* 14 *to* 19	The thick, vapory cloud-sea ("waters above the firmament") of the second day has become more rarefied, and broken into patches of cloud, so that sun, moon and stars can now shine through upon the earth.
5th Day. *Ver.* 20 *to* 23	Huge water animals ("great whales") the ichthyosaurus, etc., besides walking and flying reptiles and primitive birds, now appear.
6th Day. *Ver.* 24 *to* 31	Mammals, "beasts of the earth, and cattle," etc., and also masterful Man, now appear. [*This completes the physical creation, ready for the spiritual to begin.*]
7th Day. *Chap. II. Verse* 1, 2, 3	Sabbath: the spiritual day or era, during which the "spiritual sense" has been and still is being evolved and differentiated in man, as indicated all through the Bible, and perfected in Jesus Christ, the culminant Son of Man and the initial Son of God. Hence it is holy or hallowed time — the creational period of *spiritual* as distinguished from mere animal life.

"The evening and the morning" [or epochal culmination and decline] is recited for each day, down to the seventh; but here it is omitted—thus explicitly indicating that the seventh "day" or creational era is still in progress.

A brief account of how I was first led to construct this calendar will serve to explain it. Twenty-one or twenty-two years ago Charles Darwin's great work, "The Origin of Species," was first published, and, for several years following, the doctrine of evolution was kept in high debate. One strong argument, and which was considered "a clincher" against evolution, was this: Birds and reptiles are so utterly unlike in their structure and modes of life—the one wallowing in mire-gulfs of oozy slime, while the other soars away in free ærial flight—that there can never be any evolutional connection between these two classes of animals. Yet, within a decade were discovered the fossil archæopteryx, ramphorhyncus, compsognathus, pteranodon, ichthyornis, and the whole family of *Dinosaurs* or biped reptiles with hollow bones, gravel-grinding gizzards, and other ornithic characters, till the list of bird-like reptiles and reptilian birds became so full that no scientist could any longer dispute the completeness of the proof that the bird type of animals was evolved from the reptile type. (See geological chart, in Review for July, page 138, at "Age of Reptiles.") While studying this matter, it occurred to me that the Bible account of creation mentioned moving creatures of the water and fowls that fly above the earth as having been created on the same "day." I re-examined the old Book, and found that Gen. 1:20, 21, was a most remarkable synopsis of the latest facts discovered by modern science, to-wit: the co-ordinate origin of reptiles and birds. The passage is so striking that I will quote it:

"And God said, let the waters bring forth abundantly the moving [or creeping] creature that hath life, and fowl that may fly above the earth in the open firmament of heaven. And God created great whales, and every living creature that moveth *which the waters brought forth abundantly*, after their kind, and every winged fowl after his kind;" etc.

Vegetation had been created before this, or on the third "day" so called, and land animals appear the next or sixth "day," corresponding to the "Age of Mammals;" so that there can be no mistaking the fact that the Bible writer definitely groups the water animals, including fishes, amphibians and reptiles, together with flying creatures and birds, in one creational period or epoch, just as modern science does. And from this starting point I followed the whole matter through each way, and constructed my "Mosaic Calendar."

Let another point be observed. The Bible brings man in on the sixth "day," in common with the "beasts of the earth;" it gives him "dominion over them" —that is, designated him as the superior creature; but that is all, and the sixth "day" closes. Now, mark, it is after the "seventh day" has opened that man is spoken of as becoming a "living soul;" as giving names to the animals—the beginning of language; as being man and wife—the beginning of the family, instead of tribing or herding together; as having a consciousness of God—the beginning of the spiritual sense; and so on.

Now, what are the modern facts? Why, we are assured by competent scientists that relicts of man's existence beyond question have been found as low down as the middle tertiary, or age of mammals, in the geological scale; and that man's origin, in whatever mode it may have occurred, was contemporaneous with that of other mammals—that is, within the same creational or evolutional period. And that is in essence just what the Bible sets forth as the work of the sixth "day." Indeed, there is a vast deal of bottom truth in the old Book yet, which is worth digging for; and although science does not stop nor turn aside to serve the exigencies of any particular theological system, it is nevertheless both interesting and profitable to note how perfectly the most advanced scientific thought of our day, in regard to creational progress, accords with what is revealed and taught in The Book of books.

SCIENCE TEACHING.

BY PROF. S. H. TROWBRIDGE, GLASGOW, MO.

It is much easier to remain in a rut than to extricate one's self from it. But often the end is worthy of the effort. While I would not assert that all methods of teaching run in ruts, I hesitate not to say that the common text-book method of teaching science is in a most deep and dangerous rut. The *only* way to become acquainted with nature is to study nature herself. On account of repeated failures in the past to convince educators and school boards that this is true,

and the vast importance of the subject which forbids cessation, or wavering, of effort, even in the face of conscious defeat, I am constrained to reiterate some statements often made and to reinforce them with copious quotations from others who know from experience whereof they affirm, and whose views are worthy of consideration and acceptance.

While faith, in many things, is a most commendable and essential virtue, unquestioning faith in the statements made by authors of text-books and lectures in regard to phenomena of nature has in it more of weakness and servitude than of wisdom. Prof. Huxley says in regard to physical science: "Mere text-book work is a sham and a delusion." The committee*, on science teaching, of the American Association for the Advancement of Science, after quoting a remark of Huxley, that he "would not raise a finger to introduce more book-work into every art curriculum in the country," say: "We concur in this view as applied to the present science teaching in our public schools. We would not raise a finger to extend it." The advancement of science is so rapid that text-books, even the best, as Prof. Agassiz has said, "are already antiquated by the time they leave the press." Agassiz further says: "When we study books we are prone to remove away from the thing we study. A student of nature should, therefore, be trained at once in the difficult art of reading for himself in the great book of nature." He was accustomed to say to his pupils: "I hope you have brought no books, for I don't want you to read." Dr. Jas. LeConte, of the State University of California, says: "While a lecturer in the class-room or on the public platform may teach correct science as accepted at the time, his field is not so extended and his time so limited that he cannot keep pace with it, and thus be compelled unwittingly to teach error, as is usually the case—he cannot bring it to the full comprehension of his hearers by mere word of mouth." Dr. Whewell says: "The knowledge of which I speak must be a knowledge of things, and not merely the names of things; an acquaintance with the operations and products of nature, and not what has been *said* of them." Quoit asserts that "the bane of our school work is the confounding of knowledge with memorizing" "Cram has been defined by an English lexicographer, as a species of intellectual feeding which is neither preceded by appetite nor followed by digestion." "The value of educational systems consists simply in what they do to incite the pupil to help himself. Mechanical school-work can give instruction, but it cannot develop faculty because this depends upon self-exertion. Science, if rightly pursued, is the most valuable school of self-instruction." Committee of A. A. A. S. "Judicious oral assistance, as in the physical, chemical, or natural history laboratory, given by a competent master to a pupil at work, is invaluable for stimulus and guidance; but the aid must be discreet and the skillful teacher will not talk too much. But where it is all talk and no work, and text-books are filtered through the very imperfect medium of the ordinary teacher's mind, and the pupil has nothing to do but to be instructed, every sound principle of education is out-

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* This committee consists of E. L. Youmans, A. R. Grote, J. W. Powell, N. S. Shaler and J. S. Newberry.

raged and science is only made ridiculous." Committee of A. A. A. S. "The pupil must actually see nature in all her manifold developments, or he cannot understand her. No natural science, and especially geology, can be taught in any other way. In vain our professors attempt to describe, and the students to comprehend, without a tangible illustration."

A striking illustration of this occurred, a few years ago, in Agassiz's Museum itself, about the last place on this continent where such a thing should have taken place, but it shows the sad need of *time*, even when the specimens are at hand, to make the necessary preparations and present to the eye all the animal structure to be studied in a good course in zoölogy: A diagram of large size was thoroughly explained by the professor and exhaustively discussed, as showing the internal structure of the animal in question. After the students had made their copious notes, and gained a good knowledge of the supposed monstrous animal, they were not a little surprised, when the fact afterwards became incidentally known, that the object of their interest and study was too small to be seen without a powerful microscope. A similar proof came in my own experience. A few years ago, after a peculiarly bright class in geology had learned and recited well about the monstrous animals of the Quaternary Age, giving names, descriptions, and dimensions with satisfactory minuteness, I had the good fortune to come in possession of a large amount of mastodon remains, from within sight of the college recitation room. On showing the specimen and giving its name, I was painfully but thoroughly convinced, by the blank expression of the whole class, that not one of them had any just conception of the size or peculiarities of the animal they had so glibly described. These things and many others, demonstrate the truth of Mr. Agassiz's statement that, "the pupil studies nature in the school-room and when he goes out of doors he cannot find her." "This mode of teaching," says a committee of the American Association, "which is by no mens confined to the public schools has been condemned in the most unsparing manner by all eminent scientific men as a 'deception,' a 'fraud,' an 'outrage upon the minds of the young,' and 'an imposture on education.'"

The best place to study science is in the field. To get the greatest good from objects of nature the student, and not less the teacher, must collect them himself, so he may know their habitats and surroundings, whether they are solitary or gregarious in their habits, their associations with other animals, etc. As, however, facilities for comparative study of allied forms are not usually found in chance gatherings from day to day, these should be supplemented by *collections*, carefully arranged and correctly labeled, to which the student has free and ready access at all times.

"I confidently assert that any institution which undertakes to teach geology can no more afford to dispense with them than it can with blackboards, crayons, test-tubes, and air pumps."—Alex. Winchell, D. D., Michigan State University.

"It would be folly for any one pretending to teach geology not to make use of them."—President Hitchcock, Amherst College.

Dr. LeConte, of California, says: "Natural History cannot be taught without laboratories, museums, aquariums, and zoölogical and botanical gardens, all of which are expensive. Nor can it be taught except in small classes, by direct personal contact of teachers with pupil and both with nature; and this requires much time and a superior order of teachers."

It has been well said that the chief business of the naturalist at the present time is to *know how to compare and observe.* Prof. Crosby has said: "The great want of educational system is method and not knowledge." To meet this want, it may be said that among all of value the lamented Agassiz has contributed to science, there is perhaps nothing more valuable than his method of instruction. His object was to develop professional naturalists, and to teach his students to observe and think for themselves, the first requisites to an acquaintance with nature. At first a specimen was placed in the student's hands with no other instruction than that he find out by inspection all he can about it, and express the information he gains by drawing and describing it. To each student, as far as possible, was given a different subject, in order that he might work independently. As soon as he showed himself capable, he was set to work on some special problem in connection with his subject, in which he was to determine, by rigid comparison, its relations to other and similar forms. Each individual was closely watched in his work and asked to give reasons for all the conclusions he reached. Every erroneous one was corrected and every correct one confirmed, and he was thus led to the discovery of important truths, and not unfrequently, though erroneously, took the credit to himself. It was Agassiz's practice to lay before his students everything he was doing; to speak freely in their presence of all his scientific plans and aims; to admit them as participants in all his investigations, and even to call them by the flattering appellation of fellow investigators.

"I am convinced," says Burke, "that that method of instruction which most nearly approaches methods of investigation is the true method." "It was Bacon who advanced and stoutly defended the view that science teaching in our schools should be intuitional, living, and practical."

Study of nature cannot commence too young. Children are born naturalists, and if their childish curiosity can be encouraged and their questions satisfactorily answered, they will begin life as investigators and students of nature, and their interest in it and profit from it will increase through life. In nature they find object-lessons of amazing attractiveness and beauty everywhere and always before them. These will afford, to a thoughtful child, amusement and entertainment not only more profitable but more pleasing than frivolity. In school work, so far as practicable, each topic in science should be pursued three times during the course of study: *First*, in the primary department, where the object should be to interest the opening mind in the familiar objects of nature, and to teach the habit of observation. *Second*, in the preparatory school, where the work of classification and memorizing is to be performed at an age when memory is more plastic and impressible than ever afterward, and when the powers of observation and rapid comparison are most acute. So that—*Third*—in college course, the

student, with maturer mind, may be prepared to investigate the reasons, the causes, and the laws which underlie the facts he has previously learned. "We aim," says the committee of the Scientific Association, "to advance science by the promotion of original investigation, which depends upon men prepared for the work; do the schools of the nation, by their modes of scientific study, favor or hinder this object? Do they foster the early mental tendencies that lead to original thought; or do they thwart and express them? We have an undoubted concern in this matter, and it is, moreover, strictly identical with that of the community at large; for there can be no better test than this of the real character of a school system. When we ask whether a mode of teaching and a manner of study are calculated to awaken the spirit of inquiry, to cultivate the habit of investigation, and rouse independent thought, our question goes to the root of all true education." An attempt to study nature without abundant illustrations from nature would be like the effort of a dentist, a carpenter, or a farmer to ply his profession or trade without the use of tools or machinery. The tools of a student of nature are collections of natural objects systematically arranged, and these, like all machinery, facilitate labor and increase productiveness. But their object, it should be remembered, is not to make acquisition of knowledge in natural history easy, but to make it possible.

ARCHÆOLOGY.

ODE TO THE MOUND GRAVES.

BY JOHN EDWARDS, OF MARYVILLE, MISSOURI.

I.

Beneath the mould of this unstoried heap,
Close wrapt in coffins of their kindred clay,
Hushed in th' embrace of death's cold, dreamless sleep,
While untold years above them fleet away,
Like the winged moments of the short lived day,
May haply rest some nation's glorious dead,
Consigned to dark oblivion and decay,—
Save that poor pride hath made them here a bed,
That lifts above the common clod its turf-crowned head.

II.

The warrior here hath wrapt him in his shroud,
That shroud whose woof, though strong of old, I ween,
Now melts within the breath like the dim cloud

That fades before the daylight's ardent beam.
Sleep on! though in your sepulchre no dream
Of the to-morrow shall wake you again,
Nor in your eyes reanimate the gleam
Of passion's fire, as once the voice of fame,
To win on sanguine fields of war for you a deathless name.

III.

Ah! Could ye from this tenement arise,
Incarnate, as of old, with vocal tongue,.
Some race of yore, mayhap, might greet mine eyes,
Untold in fable and by muse unsung,
Who, when the sires of these old oaks were young,
Whose deep'ning roots amid your bones have crept,
And o'er your tomb their hoary branches flung,
Their haunts in these wild vales and forests kept,
Or o'er these hills, with bow and lance, on martial errands swept.

IV.

No harp of muse can to my listening ear,
From the far, dim oblivion of the past,
Call up the story of the race who here,
Deep pillowed, sleep death's sleep, the last,
Ere from the grave awakened by the blast
And loud *reveille* of that trumpet's peal,
Each quickened ghost shall rising stand aghast,
And e'en the bosom of this pile shall feel
The tramp, and from its dusty depths its dead reveal.

THE ALPHABET IN PREHISTORIC AMERICA.

At the recent Science Convention, at Cincinnati, Major Wm. S. Beebe, of Brooklyn, read a very suggestive paper on the inscribed records of the Mound Builders, especially those discovered at Piqua, Ohio, and Davenport, Iowa. The former were on tablets of earthernware, but the latter inscribed slates. On the Piqua tablets the characters are in horizontal lines, and in four of these lines they were, in each case, six in number. In the fifth and remaining in-instance there were five, but this arrangement was some distance, in the longitudinal direction of the tablet, from the group first mentioned, which were in both cases written in couples.

One of the Davenport slates was inscribed on one side, the other on both. The stone inscribed on but side bore on its surface a series of codcentric circles. Between the outer two of these were twelve equi-distant signs, presumably the

zodiacal signs. The slate had two perforations on one of its edges, evidently for suspension.

Major Beebe claimed that the Piqua inscriptions are the names of the eight zodiacal signs on the Davenport slate, excepting Capricornus, Aries, Cancer, and Libra, which four signs are represented by four initial letters on the back of one of the Piqua tablets, and which representing the north, west, south, and east respectively, and corresponding to the Tucatec Bacobs, or world holders, as they were called, and to which a peculiar importance is attached.

The forms of the Piqua letters are almost precisely those that occur about the Mediterranean, and whose phonetic values have been determined by Alois Hess. Major Beebe believes that he has been able to trace each form of letter to aboriginal American picture symbols, in which the same significance obtains in both European and American forms. Having fixed the significance of these letters, he has, he says, deciphered the inscription on the stone from the Grave Creek Mound, West Virginia, and that on the Pemberton ax. In all these cases the names deciphered refer to certain stellar combinations, and in the case of the slates and tables, which are perforated, were probably in the nature of charms. In the case of the Pemberton ax part of the inscription is read with edge of the ax up, the remainder with the edge down, and this inscription, too, probably, had reference to some rite or species of devination in which the ax played an important part.

A very significant feature in regard to this ax is, that the names read on the ax, when held with the edge up and down, have been preserved with the change of but one letter by an Esquimau tribe in Northwest America as the names of good and evil respectively, whereas the ax itself was found at Pemberton, N. J. The generally prevalent idea as to the relation of the Esquimaux and pre-glacial man makes this incident peculiarly suggestive.—*Scientific American.*

GEOLOGY.

FOSSIL FORESTS OF YELLOWSTONE PARK.

As explorations of the fossils forests of the Park have each succeeding year greatly added to our knowledge of their area, magnitude and wonders, during the past year I explored the hitherto unknown forests on Cañon Creek and other localities of the Yellowstone Range, Mount Washburn, and the basaltic range between the fingers of the Yellowstone Lake; also those in the mountains east of it, in the Hoodoo region, and on the Stephens Range, besides many additional localities on the Pelican and Warm Springs Creeks, as well as other well-known forests.

It is now evident that the basins of the East Fork of the Yellowstone, Pelican, Tower, and Black Tail Creeks, constitute a region of fossil forests where an excavation or erosion at an elevation of from 7,000 to 10,000 feet would most lilely unearth the fossilized branches, trunks, and roots of the giant trees of some primeval forest. Whether the successive deposits now encasing these forests in some portions of the Park to a vertical depth, of at-least 4,000 feet are subaquous or subaërial, or, as is probable, partly both, it is evident that great and long-continued oscillation of the surface and periods of submergence and elevation have occurred, as the roots of the fossil trees of these forests, little inferior in size to the "big trees" of California, often penetrate nearly, if not quite, through the horizontal stratum or layer of earth and rock upon which they grew, into the broken, shattered, and eroded trunks of the fossil trees beneath them. It is also evident, from the uniform character of the successive forests in vertical layers that the agents or influences for fossilization were for an immense period of time uniform and abundant, while those for crystalizing, though long continued, were at no period so abundant or uniformly distributed. In fact, it is not usually the largest trees, or forests of them, which are other than simply fossilized in the original forms of the timber but, rather, limited areas of usually smaller and more scattering timber, originally cnncealed in the peculiar cements which fills every crack and cavity, not only of the wood but also of the incasing rocks and their interstices, with the most beautiful chalcdony, which, probbaly, after long-continued processes of cooling, has produced the famous caskets of brilliant amethysts and other crystals here found, and which, while elsewhere unequaled in nature, are considered inimitable by art.—*U. S. Geo. Rep.*

MEDICINE AND HYGIENE.

THE ATTENUATION OF VIRUS.

So long as vaccination stood alone, the alleged prevention of a malignant disease by the voluntary production of a mild disease of similar type being a fact unique and unexplained, the anti-vaccinationists had a shadowy ground to stand on. How is it possible, they asked, to protect life and health by inviting disease? And when they boldly disputed statistics and pronounced the theory of vaccination a delusion, not a few intelligent people were confounded and prejudiced against a practice which has reduced to comparative feebleness one of the worst of the plagues of former days.

The discoveries made last year by Professor Pasteur in connection with chicken cholera, and fully described in this paper at the time, made vaccination a fact no longer unique, and gave a most promising clew to the *rationale* of its operation in making the system less vulnerable to small-pox. As our readers

will recall, that distinguished investigator of microscopic life demonstrated the living virus of chicken cholera, and proved that by suitable cultivation it could be so attenuated or shorn of its malignant quality that it would produce only a feeble disturbance of the animal organization, which yet sufficed to protect the animal as thoroughly from the more virulent disease as the latter could in case it was not fatal. More recently Professor Pasteur has investigated in a similar way the virus of the splenic fever of cattle, more widely known as anthrax and the Siberian plague; and at the late medical congress in London he gave an account of a series of discoveries in this new field, which not only add immensely to the scientific assurance of the efficiency of vaccination among men, but put into the hands of cattle owners the means of arresting a disease as destructive to domestic animals as small-pox ever was to humanity. He also demonstrates a general method of preparing virus vaccine, based on the attenuating action of oxygen and the air, which makes it probable that a virus can be prepared which, while it thoroughly protects against small-pox, will be less open to objection than humanized or even bovine virus, since the possibility of conveying at the same time any syphilitic or septic taint will be entirely obviated.

Already these investigations have resulted in the attenuation of four kinds of virus, bringing under control as many types of malignant disease.

As a proof of the protective efficiency of the attenuated virus, Professor Pasteur described the following experiment. He took fifty sheep and vaccinated twenty-five of them. A fortnight after all of the fifty were inoculated with the most virulent anthracoid microbe. The twenty-five vaccinated sheep resisted the infection; the unvaccinated twenty-five died of splenic fever within fifty hours. Within fifteen days after these results were made known more than 20,000 sheep and a large number of cattle and horses were vaccinated in and around Paris.—*Scientific American.*

LISTERINE, THE NEW ANTISEPTIC PREPARATION.

We are glad to call the attention of our readers to a new and valuable contribution to antiseptic surgery. It is called Listerine, and the thought suggesting the name is indeed a happy one. It is a combination of the essential constituents of thyme, eucalyptus, baptisia, gaultheria, and mentha arvensis. Besides these, each fluid dram contains two grains of refined and purified benzo-boracic acid. These substances, carefully prepared and combined in a solution of uniform strength, cannot fail to do good service in the treatment of all affections requiring an antiseptic.

The preparation is convenient, safe and agreeable. Locally it will be found of realy value as a dressing for wounds, ulcers, and abscesses. It may also be employed as a constituent of solutions for atomization in lung affections and of gargles in throat diseases, while internally it must prove efficacious in all forms of fermentative indigestion.

Surgeons and physicians who have made use of any of the well-known ingredients of Listerine can attest their value, and will not fail to appreciate the advantage of having them always at hand in a suitable combination.—*Louisville Medical News.*

PULQUE.

Pulque is the national drink of the Mexicans. It is produced by the fermentation of the maguey or *Agave Americana.* This plant has been considered diuretic and antisyphilitic. There is no authenic record as to who first made pulque or neutli. Many are the traditions extant among the Mexicans concerning its first manufacturer. It seems, however, to be the more general belief that it was Xochitl, daughter of a nobleman called Papantezin, who lived in the time of Tapancaltzin, eighth king of the Toltecs. From time immemorial pulque has been considered to contain medicinal virtues in a very high degree as well as all the other products of the maguey, and at one time the maguey was even said to hold a spiritual life and was held in reverence. To-day pulque is esteemed by the ignorant classes as having a variety of curative powers, and physicians use it for its alcohollic and nutritive properties. It is held as a stiumlant, tonic and antispasmodic. They recommend it to the infirm, weak, anæmic, and nursing mothers.

It is obtained by fermenting the juice expressed from the central portion of the maguey plant. After expressing the juice between rollers, or as was formerly done by means of suction, it is carried to the vats for fermentation. These vats consist of raw ox hides loosely suspended in a strong wooden frame, with the hair on the outside. These hide-made vessels contain the cryptococcus or ferment, which is a residuum of the former fermentations. After a few hours fermentation is fully established and the pulque is drawn off, always leaving a residuum in the vessel for the next fermentation. The liquid obtained from the maguey plant has a density varying from 1.029 to 1.042 and contains in 100 parts 9.553 of sugar, 0.540 of gum and soluble albumen, 0.726 salts, and 89.181 of water holding in solution resinous matter, fats, albuminoids, starch, dextrine and glucose.

According to Don Jose Ramos, its salts contain potash, soda and lime in moderate proportions, and magnesia and alumina as chlorides, carbonates, sulphates and silicates; hence the great value in which it must have been held in former times and in which it ought to be held at the present day.

From the composition of the juice of the maguey one may have an idea of the therapeutic effects of the pulque, allowing for the change which these constituents may undergo through fermentation. Pulque has no definite proportion of alcohol, for one may readily see from the way it is manufactured that it cannot have any definite standard. It, however, contains a very small proportion of fusil oil, and carbonic acid in large quantities. Considering that its manufacture

is not based upon any standard of purity, or even with ordinary care, its density cannot be given with any certainty, though it varies from 0.9943 to 1.0200 ("La Esquela de Medicina"). To-day it is attracting the attention of the medical fraternity because of the evil effects upon the liver caused by its excessive use among the lower classes, not, however, in the light of pulque as a compound, but because of the evil effects of the alcohol which it contains. It is therefore proposed to adopt some other form of manufacture that a much lower percentage of alcohol may enter into its composition, according to a fixed standand, and thus avoid the evils of alcoholism.—*By E. E. Riopel, M. D., in the Therapeutic Gazette.*

THE TENURE OF LIFE.

An industrious German, Baron G. F. Kolb has lately compiled a book of universal statistics which furnishes much food for thought. His figures show that every advance made by a people in morality, in profitable and healthy employment, and useful knowledge brings it nearer to the ideal—the greatest natural tenure of life. Domestic virtue also tells favorably on the health and wealth of a population. Thus in Bavaria, out of 1,000 children born alive there died, of legitimate children, 248 boys and 212 girls; of illegitimate, 361 boys and 342 girls. Out of 100 children suckled by their mothers, only 18.2 died during the first year; of those nursed by wet nurses, 29.33 died; of those artificially fed, 60 died; of those brought up in institutions, 80 died in the 100. The influence of prosperity or poverty on mortality is also shown by Baron Kolb. Taking 1,000 well-to-do persons and another 1,000 of poor—after five years there remained alive of the prosperous, 943; of the poor 655. After fifty years there remained of the prosperous, 557; of the poor, 283; at seventy years of age there remained 235 of the prosperous, and of the poor, 65. The average length of life among the well-to-do was 50 years, and among the poor 32 years.

One of the most potent shorteners of life is the anxiety of providing for bare subsistence. The lack of sanitary conditions also shortens man's years. Idleness, as compared to intense industry, outweighs—prejudicially outweighs—all the advantages of ease and abundance.—*Scientific American.*

COLOR-BLINDNESS AND EDUCATION OF COLOR-SENSE.

The examination instituted by Dr. B. Joy Jeffries among the pupils in the schools of Boston (including 14,469 boys and young men, and 13,458 girls and young women) have shown that about one male person in twenty-five is color-blind, while the defect occurs with extreme rarity in girls and women (only 0.066 per cent. of the female pupils in the schools). The researches that have been

made in Europe show that a similar law as to the relative proportion of color-blindness between the sexes prevails there. The subject has been over-looked until within a few years, but the value of the knowledge of it that has been gained cannot be disputed. This knowledge can be applied practically on a scale of considerable extent in determining the vocation to which boys should be trained. A person who is color-blind is obviously unfit for any business in which he must know how to distingush colors. Yet the person himself and those who are around him are seldom aware of his defect.

If examinations are regularly made in the schools and records kept of them, as has been done by Professor Jeffries, a sure practical test may be found which can be applied directly to each person, so as to guide him aright on this point. The inquiries of Dr. Jeffries have disclosed a great lack of knowledge of colors, aside from color-blindness, among adults as well as among the boys in the schools. But very few boys of the grammar or higher schools, he says, are familiar with the color-names of even the primary colors, and still less can they correctly apply those names they do remembe, when shown colored objects. "I have received letters from adults, not color-blind, whose lack of color-names had been a serious drawback to them in their occupations in every-day life; and they have besought me to urge the teaching of color-names and the education of the color-sense in our public schools." The teaching of colors and color-names has been partly introduced into our primary schools, but without any system; it has been begun in Europe, especially in Germany, in the lowest schools, in a systematic manner.

The exemption of women from color-blindness has been attributed to their familiarity with color objects and materials; but this holds only of the sex as a whole, not with reference to individuals, for the color-sense cannot be changed with practice in colors. The question arises whether generations of color-education have caused this sexual difference, and is important; for, if answered in the affirmative, it proves that we may begin to eliminate color-blindness from future generations of boys by teaching and exercising the present generation in the perception and distinctness of colors.

DIAGNOSIS OF BLOOD-STAINS.

Dr. J. G. Richardson, of Philadelphia, gives the following summary of the results of his measurements of blood-corpuscles:

First—That in unaltered blood-stains, as ordinarily produced by the sprinkling of drops of blood upon clothing, leather, wood, metal, etc., we can, by tinting with aniline or iodine, distinguish human blood-corpuscles from those of the ox, pig, horse, sheep and goat, whenever the question is narrowed down by the circumstances of the case to these limits.

Second—By the method I have devised we can measure the size of the corpuscles, and apply the two corroborative tests of tincture of guaiacum with ozonized ether and of spectrum analysis, to a single particle of blood-clot weighing

less than one fifteen-thousandth part of a grain, a quantity barely visible to the naked eye.

Third—Hence, when an ignorant criminal attempts to explain suspicious blood-spots upon his clothing, weapons, etc., by attributing them to the ox, pig, sheep or goat, or to any of the birds used for food, we can, under favorable circumstances *absolutely disprove* his false statement, and materially aid the cause of justice by breaking down his lying defense, even if twenty years have elapsed.

Fourth—But, if the accused person ascribes the tell-tale blood to a dog, an elephant, a capybara, or any other animal in Dr. Woodward's list, it is useless to attempt to dispute his story on microscopical evidence as to the size of the blood corpuscles.

Fifth—In cases of innocent persons wrongfully accused of murder, and really stained with the blood of an ox, pig, or sheep, testimony of experts, founded upon measurement of the corpuscles, would be valuable, but less conclusive, because, under certain circumstances, human blood-corpuscles may *shrink* to the size of those of the ox, whilst under no known condition do ox or pig corpuscles *expand* to the magnitude of those in human blood.

Sixth—In order to do away with ingenious objections of lawyers that the murdered person may have been affected with some disease which altered the size of his blood disks, or that the articles of clothing, etc., upon which the stains were deposited had produced, chemically or otherwise, some similar change in their magnitudes, it is very important to obtain, promptly, stains from the fresh blood of the victim, made in the presence of witnesses, upon portions of the prisoner's clothing, or weapons analogous to those upon which suspicious red spots are found when he is arrested. When this cannot be done, spots of the murdered person's blood, sprinkled on white paper, and fragments of his lungs and kidneys, should be carefully preserved, the former by rapid drying and the latter by preservation in diluted alcohol. These little precautions, which may in any instance, prove to be of infinite importance, should be earnestly impressed upon coroners, district attorneys and policemen, throughout the civilized world.—*American Monthly Microscopical Journal*

THE LARGEST PYRAMID.

We believe it is not generally known that the largest existing pyramid rests on American soil. The Pyramid of Pueblo, in Mexico, is larger than the great Pyramid of Cheops, in Egypt. The latter covers only fourteen acres, while the Mexican one covers forty-four acres of ground and was originally 600 feet high. It is made of sun-dried brick, and is supposed to have been built 7,000 years ago.

BOOK NOTICES.

ANNUAL REPORT OF THE REGENTS OF THE SMITHSONIAN INSTITUTION, FOR THE YEAR 1879. Octavo, pp. 631, Government Printing Office, Washington, D. C.

This Report, prepared by the able, earnest Secretary and Director, Spencer F. Baird, comprises the following points, viz:

1. Annual report of the Secretary, giving an account of the operations and condition of the establishment for the year 1879, with the statistics of collections, exchanges, etc.

2. Report of Executive Committee, exhibiting the financial affairs of the Institution, including a statement of the Smithsonian fund, the receipts and expenditures for the year 1879, and the estimates for 1880.

3. Proceedings of the Board of Regents for the session of January, 1880.

4. General appendix, consisting of scientific papers, original and selected, of interest to collaborators and correspondents of the Institution, teachers, and others engaged in the promotion of knowledge, contributed by such well known writers, explorers and original investigators as Professors E. S. Holden, Otis T. Mason, G. C. Broadhead and Franz Joseph Pisko, and Messrs. Edward H. Knight, Brainerd Mitchell, James Hough, S. T. Walker and many others, including several prominent army officers whose anthropological articles are of the highest value.

If so interesting and instructive a work were to be published by a regular publishing house and not known as a "public document" the demand for it would be unusual.

BOOK OF THE BLACK BASS. By James A. Henshall, M. D. Large 12mo, 463 pages; Cincinnati, Robt. Clarke & Co., 1881. $3.00.

It is impossible to read this book, which is devoted to a scientific and life history of the black bass and a practical treatise on angling and fly fishing, with a full description of tools, tackle and implements, and which contains scores of illustrations, without becoming convinced that Dr. Henshall is a true "brother of the angle," as well as a thoroughly informed naturalist, on this subject at least.

One hundred and ninety-one pages are given to the scientific history of the black bass, its nomenclature, morphology and physiology with instructions for stocking inland waters with this valuable and attractive food; one hundred and thirty-six to description of rods, lines, hooks, flies, baits and miscellaneous implements and one hundred to instructions and directions for angling and fly fishing

The work is attractive in appearance and style, and even the most technical parts are written in an easy and popular manner that will interest every sportsman as well as furnish valuable information to the amateur natur alist. The enthusiasm of the writer soon extends to the reader and when he lays the book down he feels that he has gained instruction and entertainment of a new and satisfactory kind and, if the information furnished is put to proper use, that he may avoid many an attack of dispepsia and other life-shortening disease.

UNDERGROUND TREASURES, HOW AND WHERE TO FIND THEM. By James Orton, A. M. 12 mo. pp. 145. Philadelphia, 1881, Henry Carey Baird & Co. $1.50.

This little work, notwithstanding its somewhat fanciful title, is a genuinely practical and useful one, being intended not for mineralogists, but for the landholder, the farmer, the miner, the laborer, even the most unscientific. It is designed to enable such to discover for themselves minerals and ores of use in the arts and thus develop the resources and ascertain the value of any particular tract of land or bed of supposed mineral. It is offered as "a key for the determination of all the useful minerals within the United States," and, being the careful production of such a student and naturalist as the late Professor Orton, there can be no question of its entire reliability in this respect.

This is a new edition carefully revised by the author and handsomely illustrated.

REPORT OF THE COMMISSIONER OF EDUCATION, 1879. Hon. John Eaton; pp. 757, octavo. Government Printing Office.

In submitting his tenth annual report, covering the year 1879, the Commissioner of Education states that the demand upon the office for information has been greater than during any previous year. The printing of circulars has been more than double, and pet the number has not been sufficient to set forth all the information desired upon important phases of education. The circulars are entitled as follows:

No. 1, 1879. Training schools for nurses.

No. 2, 1879. Papers, addresses, discussions, and other proceedings of the Department of Superintendence of the National Education Association, at the meeting held at Washington, D. C., February 4, 5, and 6, 1879; the proceedings of the Department of Superintendence of the National Education Association for 1877; and the proceedings of the conference of the presidents and other delegates of State universities and State colleges for 1877.

No. 3, 1879. The value of common school education to common labor, by Dr. Edward Jarvis, of Worcester, Mass.; together with illustrations of the same as shown by the answers to inquiries addressed to employers, workmen and observers.

No. 4, 1879. Training schools of cookery.

No. 5, 1879. American education, as described by the French Commission to the International Exhibition of 1876.

A series of letters selected from those received during the first four months of the year indicates the character of inquiries addressed to the Office. They relate chiefly to school legislation, methods of teaching and discipline, and courses of study, or request advice and direction for the establishment and conduct of normal schools and teachers' institutes, for the creation of public schools where none exist, for the investment of school funds, etc.

The matter of the report is derived from the reports of States, Territories, and cities, of schools of all classes, and of various related institutions, as libraries and museums. The number of these correspondents increases yearly; in 1879 the total was 7,869 for the American matter alone.

The Commissioner refers to the great progress made during the year in the classification and arrangement of the Office library, whereby the current work is facilitated.

OTHER PUBLICATIONS RECEIVED.

Report of the Commissioner of the General Land Office, 1880; Report of the operations of the U. S. Life Saving Service, 1880; Diseases of the Hog and their Cause and Cure, 46 pp. 12 mo.; Constitution, list of Meetings, Officers, Committees, and Members of the American Association for the Advancement of Science for the Cincinnati Meeting, August, 1881, by F. W. Putnam, Permanent Secretary; Bulletins Nos. 1 to 6, 1881, of the Essex Institute, Salem, Mass.; The Manuscript Troano, by Prof. Cyrus Thomas; The Ancient Mounds of Illinois, by Hon. Wm. McAdams, Jr., Otterville, Illinois; The Preparation and Use of Cements and Glue, by John Phin, pp. 58, 12 mo.

The *Student Monthly*, devoted to the interests of education in the Society of Friends at Haverford College, Pa. The Annual report of the Proceedings of the Stockholders of the Northern Pacific R. R., September 15th, 1881; The Pollination of Yucca and on Pronuba and Prodoxus, by Prof. C. V. Riley, Washington, D. C.; Proceedings of the California Acacemy of Sciences, June 6th, 1881; The State and Higher Education, by Prof. N. H. Winchell; Annual Report of the Board of Directors of the Chicago Astronomical Society, 1881; Descriptions of some New Tortricidæ (Leaf-rollers) by C. V. Riley, M. A.. Ph. D.; First Annual Report of the Astronomer at the Winchester Observatory of Yale College, 1880–81, by Leonard Waldo; A report on the Teaching of Chemistry and Physics in the United States, by Prof. F. W. Clarke, S. B., of the University of Cincinnati; Catalogue of the Phænogamous and Vascular Cryptogamous Plants of Michigan, by Charles F. Wheeler and Erwin S. Swith, Lansing, Michigan, 1881, price 50c.

Proceedings of the Polytechnic Association of the American Institute, Thos. D. Stetson, President; The Origin and Reproduction of Pine Forest by Wm. Hosea Ballou, of Evanston, Ills.; On the Ratio between Sector and Triangle in the Orbit of a Celestial Body, pp. 3, quarto, Prof. Ormond Stone, Cincinnati Observatory.

SCIENTIFIC MISCELLANY.

METEOROLOGICAL REPORT FROM AUG. 20, TO SEPT. 20, FROM OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA, KAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

TEMPERATURE OF THE AIR.	Aug. 20th to Sept. 1st.	Sept. 1st to 10th.	Sept. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	68.0	58.7	49.3	58.7
Max	96.0	89.5	80.9	88.9
Min. and Max	81.0	74.1	64.9	73.3
Range	28.0	30.8	31.5	30.1
TRI-DAILY OBSERVATIONS.				
7 a. m.	76.4	69.8	57.8	67.7
2 p. m.	94.3	82.7	74.5	83.8
9 p. m.	80.1	72.2	62.1	71.5
Mean	83.6	73.9	64.3	73.9
RELATIVE HUMIDITY.				
7. a. m.	.68	.79	.66	.71
2 p. m.	.48	.60	.34	.47
9 p. m.	.63	.68	.64	.65
Mean	.64	.69	.58	.64
PRESSURE AS OBSERVED.				
7 a. m.	29.02	28.97	28.99	28.99
2 p. m.	28.99	28.93	28.95	28.96
9 p. m.	28.97	28.94	28.96	28.96
Mean	28.99	28.95	28.97	28.97
MILES PER HOUR OF WIND.				
7 a. m.	8.0	19.4	15.2	14.2
2 p. m.	14.8	23.6	21.2	19.9
9 p. m.	11.9	15.6	10.1	12.5
Total miles	3105	4728	3493	11326
CLOUDING BY TENTHS.				
7 a. m.	4.1	5.7	2.0	3.9
2 p. m.	4.9	5.8	2.1	4.3
9 p. m.	1.3	4.6	0.9	2.2
RAIN.				
Inches	.10	1.77	0.25	2.12

Highest Barometer during the month 29.18 in., on the 8th. Lowest Barometer during the month 28.79 in., on the 16th.

Highest temperature during the month 102°, on the 27th. Lowest temperature during the month 35°, on the 17th.

Highest velocity of the wind 44 miles per hour, on the 3rd.

The usual summary by decades is given above.

THE PRACTICAL VALUE OF SCIENCE.

An orator of the present day, says the *American Journal of Science*, who firmly believes that science is the sublime teacher of all practical knowledge, has beautifully said, in one of his lofty perorations, that "reason, observation and experience constitute the holy trinity of science." Looking over the years which have elapsed since the Middle Ages, the frightful ignorance and superstition of which cover many black pages in history; when all knowledge of a scientific character was held in utter contempt, and only a few out of the many could read or write the English or any other language; when the astrologer took the place of the astronomer, and men, women and children believed in the existence of ghosts, witches, hobgoblins, and saw signs that the world was going to be speedily demolished and turned into a still blacker chaos than their wretched ignorance caused to prevail; when science lay strangled in the cradle and was threatened with instant death if it had the temerity to heave a palpable breath; in looking over the years which have made their circuit and been ushered into the realm of oblivion since then, and marking the progress of science, which was necessarily slow at first, but quickened its march, century after century, until the nineteenth was reached, when it made a sudden and grand flight upward, it would be amazing indeed if we did not behold the mighty advancement in human affairs with awe and unbounded admiration. When ignorance and superstition covered the brains of man like a black cowl, their reason was obscured and advancement was simply impossible; but when they ceased consulting oracles and having dealings with ghosts and witches, and turned their attention to the study of their surroundings, their wants as well, and how to supply them, a new light illuminated the human brain where formerly only savage instinct dwelt, and man and the world began to improve simultaneously. The knowledge of the engineer opened up canals, river channels, and gave us the railway; and these made inter-state commerce practicable, and now we have international commerce. In order to make the earth yield him a substance, man used to sweat and toil and die prematurely from hard work; but since science has given him machinery and all kinds of mechanical appliances, he finds the world to be an Elysium to live in compared with what it used to be. Science has not only enabled him to produce two blades of grass from one and make one bushel of potatoes yield a dozen bushels or more but it has also brought the very market to his door, as it were; it has given him in geology a sure and eternal guide to all the minerals which the earth holds in its bowels, and has furnished the means of readily extracting the same. All there is of music, art and beauty has been bestowed upon us by this great benefactor

of the human race, and its shining genius is immortalized in every step forward that man has taken.

Geology doubtless has been one of the greatest aids to our race in making its marvelous progress, and of it we desire to speak more particularly. Minerals furnish the basis of nearly all the useful arts and manufactures, and had it not been for geology we never would have had any. It made the discovery that mother earth possessed within herself all the minerals of which we know anything—gold, silver, coal, zinc, lead, iron, baryta, ochre, peat, etc., and without all these, or most of them, what would our boasted progress in civilization and the arts be worth? Indeed, it is highly probable that had they remained forever hidden we would never have acquired the cheerful habit of boasting. Many a fortune has been sunk in searching and experimenting for coal, gold, lead, zinc, iron or other ores, in places where the Pyramids might be looked for with the same chance of success in finding them. Bitter experience has taught many prospectors and miners how indispensable to their success is a knowledge of geology. Late geological studies of the Hoosac Mountain have proved that millions of dollars might have been saved to the State of Massachusetts if like studies had been made before the excavation of the great Hoosac tunnel. It is asserted that enough funds were needlessly expended to pay for a complete topographical, zoölogical, geological and botanical survey of the whole commonwealth, such as no State in the Union now possesses, and such as would for ever put away the danger of similar loss in the future. Geology must determine the cost of production of the precious metals, such as gold and silver, and their probable abundance for centuries to come.

The practical value of science in its various departments is too manifestly great to be ignored by any one interested even in a small way in the grand procession of progress. Americans in particular cannot devote too much attention to the study of it in its various branches, as their national preëminence is due to their intimate and practical knowledge of all really scientific subjects, and it behooves them especially to continue to be the friends and patrons of science.—*The Manufacturer and Builder.*

THE FUTURE OF ELECTRICITY.

The remark is common enough in the mouths of the common people as well as of the scientists that the future developments of electricity, as an applied art, have been as yet only dimly foreshadowed. It is the modern miracle-worker and after the telegraph, the telephone and the phonograph. The world is very ready to receive with credence any statement of the wonderful things yet to come. The fairs which Boston is to have this Fall will give us a clear idea of the progress of the last few years, and this department will not be equaled in the amount of interest shown in it by any other in the exhibitions. Meanwhile, in the French capital preparations are going forward for an exhibition to be held the coming

Fall to be devoted entirely to electricity and its applications. It will give brilliant illustrations of the present condition of the science, and will prefigure the progress to be looked for in the near future. The exhibition will be held in the Palais de l'Industrie, to which visitors will be carried on an electric railway. The trains will consist of two saloon carriages, and an electric motor which will take from the rails the fluid supplied by generators at the end of the line. In the center of the Palais will be a small pond in which a steamer will lay a submarine cable.

In the basement of the building will be illustrated all varieties of such cable and wire manufacture, adjoining but not forming part of the official portion of the exhibition, which will comprise all forms of government electric apparatus, manipulators, receivers, piles, telegraph posts, insulators, switches, and a thousand other matters of necessary detail in the complicated system of commercial or military telegraphy. Towering above the building will be an immense lighthouse carrying a light of great power. By daylight the visitors to the exhibition will watch the operations of a whole army of telegraphists, machinists, etc., while at night this swarm of operatives will be visible under the glare of a thousand electric lights streaming from the roof. It is intended to include among the illuminators every known burner, and a score or more are now known.

Among the "inevitables" of the exhibition we may look for fire alarms, electric dials, municipal and police calls, etc. The railroad companies will show their signal systems, electric brakes and alarms and a new carriage for registering the velocity of trains, force of wind, consumption of steam, etc. The upper story has been devoted to scientific curiosities and fanciful inventions for the delectation of the curious but untechnical observer. Telephones will be connected with the theatres and the operas and the visitor to the exhibition will be allowed to hear the utterances and the music at any or all of the places. Connection by telephone will also be made with distant cities. Next will come a series of eight rooms, literal copies of a Parisian apartment of the present day, where everything will be, so to speak, run by electricity. The kitchen will be lighted by electric lamps; the range heated by electric currents passing through water; a half-dozen cooks, by means of incandescent platinum wires, will turn out waffles and cakes, and electrically heated metallic plates will serve for braziers and chafing dishes. The dining-room will be fitted out with all the wondrous new apparatus which already threatens our peaceful firesides with its novel blending of science and comfort. The central sunlight in place of a chandelier can be lighted by the pressure of a button or the opening of a door. The dishes will be brought up on an electric dumb-waiter. The only thing left to do would seem to be to eat by electricity, and, in view of the wonders accomplished, even that seems not so very improbable. The parlor will be furnished with electric chandeliers, mantel clocks going by electricity and adorned with electrical groups and figures, telephones and electric fire-places. In the billiard-room an electrical table will enable the player, if not to make his caroms, at least to mark them by an electrical indicator. The bed-room, besides all sorts of electric calls, will have electric hair brushes which will be made to dress the hair in a twinkling by press-

ing a button attached to the apparatus. Finally, a room will be given to electric views, projections and toys; miniature telegraphic apparatus, trick boxes, magic lanterns, railways, dolls and automata for the amusement of children. All this, strange as it may seem, is an actual fact, or will be very soon. Applications for space have been pouring in and the lists are now closed. The exhibition will be educational besides being very unique.—*Manufacturers' Gazette.*

A NEW FIBRE.

The Louisville *Courier-Journal* gives the following description of a new material for use in bagging and rope manufacture which has been exhibited in that city: "This beautiful, strong, clean fibre is produced from the plant known in this State as beargrass, and further south as the Spanish dagger. The family of Yucca contains about a dozen varieties, all stout, strong leaved plants, and has been used in Kentucky time out of mind for hanging meat while curing in the smoke-houses. This family of plants is known as a beautiful and abundant bloomer; long, tough, pointed fibrous leaves. The plant is omnipresent everywhere in the South, south of forty degrees north latitude. This plant is another item in the long list of the untold resources of the South. Its fibre is as strong as hemp or jute, and almost as indestructible as iron, except by the action of fire. Some of its advantages may be briefly summed up. The plant grows more than one hundred years; loses less than one-tenth in cleaning; it is the strongest coarse fibre in the world; will not shrink when it gets wet in rope; yields largely; requires no cultivation after the third year; is worth ten to fifteen cents per pound when cleaned, and grows spontaneously everywhere south of thirty-one degrees. —*National Scientific Journal.*

JAPANESE LACQUER.

The manufacture of lacquer, an industry for which the Japanese is deservedly celebrated, was made a special object of study by Sir E. J. Reed on his recent visit to the Flowery Land, and the following notes are mainly taken from his interesting volume:

"The Japenese lacquer is usually upon article of wood, and not upon articles of *papier-mâché*, as many suppose. It is produced from the sap of the *Rhus vernicifera*, which is taken in its natural state into a large wooden tub or vat, and then stirred in the sun with a large spatula, until its excess of water is evaporated. In some cases the varnish so produced undergoes careful straining; in other, it is mixed with sulphate of iron, with virmilion, with red oxide of iron, or with indigo; oil is sometimes employed, likewise powdered stone. Into some inferior varnhishes, a sort of paste made of rice enters in considerable proportion. There are a dozen methods of employing the various varnishes, differing according to the nature of the object to be produced. In the best lacquer, numerous coatings are applied, dried, and polished successively. The first polishings are done with

a stone named *tsu shimada* (suitable for hones), the latter by means of water, and a charcoal made from *Andromeda ovalifolia*, and the last with pulverized stag's horn. All the plishings are effected by the hand. When gold is used in smooth surface lacquers, where it is not to be in relief, the process is as follows: The design to be produced is traced on a leaf of paper, which is then reversed, and has repeated upon the opposite side of it the outlines and other features of the design, in a mixture of varnish and vermilion, softened over a mild fire. This side of the paper is then applied to the lacquer to be decorated, and the paper is then applied to the lacquer to be decorated, and the paper is rubbed and pressed upon it by means of a small spatula of bamboo. The transfer of the pattern from the paper to the lacquered surface is further assisted by gently beating the paper down with a small silken bag, containing powdered stone. The paper is then peeled off, and can be used again if desired. The slight relief of the pattern so produced upon the lacquer is rubbed down with carbon polish, and the design, and that alone, is then lightly covered with a thin layer of quickly drying varnish. Gold, in powder, is then applied to the moist surface by means of a camel-hair pencil if the gold powder be fine, and by means of a small tube if it be comparatively coarse and heavy. The article is then dried for a day in a warm closet, such as is used for drying the ordinary lacquer varnish.

"The design is next lightly cnated with a very thin layer of varnish, applied by means of paper steeped in it, and passed very delicately over the object, which is then redried in the closet. The object receives further extremely light coatings of varnish and subsequent polishings before it is complete. Silver is applied to designs in relief, the details of the process vary considerably, but the application of the metals is effected in substantially the same manner. When gold and silver are appied in leaf, they are laid upon the varnished surface prepared for them, and dealt with in the usual manner, the varnish acting as a "size" for the metallic leaf. When mother of-pearl is used as an incrustation for lacquer it is laid on during the varnishing processes, earlie, if it be thick than if it be thin, and the final polishing processes, earlier if it be thick than if it be thin, and the final polishing is proceeded with until the pearl is brought to the surface."—*Scientific American.*

A HINT ON ARRANGING FLOWERS.

Vick's Floral Monthty says: A new device for the arrangement of flowers consists of a piece of cork about a quarter of an inch thick, circular in form, and perforated with holes like the rose of a watering-pot. The diameter of the cork is made to correspond to the size of the saucer or shallow dish with which it is to be used. The cork floating on the top of the water supports the flowers, whose stems are inserted through the holes. For the display of small flowers and those having short stems this method seems well adapted; possibly it may be better than damp sand, though that is doubtful, but, as the cork may be preserved, it would always be at hand, and it might not be convenient sometimes to procure sand.

EDITORIAL NOTES.

THE editor of this magazine, having been prevented by severe illness and absence from home during the past two months from giving much personal attention to the REVIEW, desires to express his obligations to Prof. J. D. Parker and Mr. Samuel R. Hudson for valuable services in preparing and superintending its publication for September and October.

PROF. FAILYER, in the *Industrialist*, for September 24th, says, editorially, of the new Secretary of the State Board of Agriculture, of Kansas: "We feel confident that Secretary Coburn will be a success, and a worthy successor of Gray and Hudson every way. He has in him the thorough knowledge of the details of the Kansas farmer's life; and his reports, we are sure, will "come straight home" to the practical farmer of all sections of the State. Mr. Coburn has in him the energy and growth needed for the position."

THE Geographical Congress at its session in Vienna, awarded to the American section letters of distinction for various topographic and hydrographic surveys and publications by Government officials, and for a series of publications by the Post-Office Department; also a diploma of honor, second-class, to the Agricultural commission. Honorable mention is made of the Treasury Department reports.

WE have received from D. Appleton & Co. a copy of Tylor's *Anthropology*, which we shall notice in our next number. In the meantime we will call the attention of our readers to the full and interesting review of the book, in this issue, by Prof. Alexander Winchell, borrowed from *The Dial*, by which it will be readily seen that it is just such a work as all students of anthropology will desire to have.

THE Tenth Annual Report of the Kansas City Public Schools for 1880–81, is a volume of 132 pages and gives a most favorable and gratifying account of the progress made in the manner of and facilities for teaching, as well as that made by the pupils themselves. As it is a matter of local interest and every one who desires it can obtain a copy for himself, we give no details, but will simply congratulate our citizens upon having so competent and energetic directors, superintendents and teachers.

WE now have two first-class medical colleges in Kansas City; the Kansas City Medical College (late College of Physicians and Surgeons,) now in its thirteenth year and well known throughout the whole New West, and the Medical Department of the University of Kansas City, just commencing its career as an institution of learning. Both have Faculties made up from the very best medical talent in the city; both are erecting new buildings with all the modern facilities for teaching, and both, we sincerely hope, will receive sufficient patronage from the vast regions west of us, so rapidly filling up and demanding the best professional skill of the day, to cause them to succeed to the fullest expectation of their originators.

OUR fellow citizen, C. C. Hare, has invented and constructed a base burning, smoke consuming hot-air furnace for soft coal, which he styles the "Bituminous King." We have examined it with some care and believe that he has discovered the most correct and practical means of effecting the complete combustion of soft coal that has yet been presented to the public. This has been a great desideratum in the West and Mr. Hare deserves the congratulations and patronage of its people in the interest of economy and home thrift.

WE were favored with a call from Prof. E. D. Cope, the distinguished Philadelphia naturalist, on the 10th ult., but unfortunately had just left town on a health trip to the Atlantic coast.

ITEMS FROM PERIODICALS.

THE October number of *Popular Science Monthly* concludes the nineteenth volume of this truly popular magazine. No scientific periodical in the country, if even in the world, has ever taken with the people as this has done and it is gratifying to learn that its subscription list is still gaining. $5.00 per annum is a very low price for more than 1,500 pages of such matter as is regularly furnished in the course of every year to its readers.

THE November *Atlantic* will contain, in the way of fiction, further installments of the two serial novels, and a short story of western life, by a new contributor. A charming paper by Mr. John Fiske; a discussion of the question, When did the Pilgrim Fathers land at Plymouth? by Mr. Sidney Howard Gay, and a reminiscence of factory life in Lowell, by Miss Larcom, will be prominent among the miscellaneous matter in this number.

THE November number of *Harper's Magazine* will contain, In Cornwall with an Umbrella, by W. H. Rideing, illustrated by C. S Reinhart; A Week in a Dug-out, by W. W. Thomas, Jr., illustrated; Tilghman's Ride, a poem by Howard Pyle, based on an incident connected with the Surrender of Cornwallis, with illustrations by the author; Journalistic London,—the second of a series of papers by Joseph Hatton—illustrated by portraits and sketches; Ohio's First Capital, —a sketch of Chillicothe and of the pioneer history of Ohio—by Alfred Mathew—illustrated by portraits and views; The Land of the Midnight Sun, an illustrated paper by John Habberton, apropos of the publication of Du Chaillu's work bearing the same title; Ead's Ship Railway, by John A. Dillon, illustrated; a paper by Prof. John Fiske, entitled, How America came to be Discovered; the continuation of the two serial novels by Miss Woolson and Thomas Hardy, short stories, etc.

Van Nostrand's Engineering Magazine for October presents the following table of contents: Whirled Anemometers, illustrated; Note on the Friction of Timber Piles in Clay, by A. C. Hertzig, illustrated; Protective Works on the South Rangitata River, N.Z., by John H. Low; On Steel Castings, by Mr. Frank W. Dick; Hydraulic Mortars, by Dr. Michaelis; On Light Railway Locomotives, by Herr Von Borries; Theory of the Action of Railway Brakes, by E. Perron; Working of Light Railways on Common Roads, by Herr Buresch; The Dupuy Direct Process, Uniform Standard Time, by Sanford Fleming; The Projected Simplon Tunnel Through the Alps, by G. T. Lommel; The Goldschmid Aneroid, illustrated; The Art of Founding in Brass, Copper, and Bronze, by Edward Tuck; Theory of the Injector, by E. Herman; On the Maintenance of Pure Air in Dwellings; Gas for Light and Heating, by Dr. C. W. Siemens; On the Progress and Development of the Marine Engine; Determination of the Efficiency of Large Cylindrical Iron Tanks, by John D. Crehore; The Actual Lateral Pressure of Earthwork, by Benjamin Baker, illustrated; Paragraphs, Reports of Engineering Societies, Engineering Notes, Iron and Steel Notes, Railway Notes, Ordinance and Naval, Book Notices, and Miscellaneous.

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CHEMISTRY AND METALLURGY.

JOPLIN CITY WHITE LEAD WORKS.

BY ERASMUS HAWORTH.

The visitor to Joplin City, Mo., should not fail to see the white lead manufacturing establishment of that city. For centuries past white lead has been used very extensively in almost all kinds of paints. The process of its manufacture, until within the last few years, has been very simple in practice, although a little complicated in chemical action. The oldest process of which we have any account consists simply in hanging spirally-shaped strips of sheet lead over open vessels of fermenting vinegar. In a few days the strips of lead become covered with white lead. This is then scraped off, the strips replaced over the vinegar, and thus the operation repeated indefinitely.

The vapor of acetic acid, rising from the vinegar, acts upon the surface of the lead forming a basic acetate of lead. The carbonic oxide liberated by the fermentation of the vinegar subsequently breaks up the sub-acetate, forming as the principal resultant lead carbonate, or white lead.

Another process, similar chemically, consists in dissolving litharge (*lead oxide*) in acetic acide until the triplumbic acetate is obtained. Through the solution of this salt carbonic oxide is passed until the whole of the triplumbic acetate is converted into lead carbonate (*white lead*) and neutral lead acetate. Upon boiling the neutral lead acetate with litharge more triplumbic acetate is produced, so that, with the exception of the unavoidable loss in the manipulations, a given amount

of acetic acid will serve in manufacturing an indefinite amount of white lead. Until quite recently all of the white lead used in the arts has been made by one of these processes.

A few years ago a gentleman from Philadelphia, Mr. E. O. Bartlett, came to Joplin city professing to have patented a process by which great quantities of white lead could be saved from the vapors that escape up the flues of the smelting furnaces. His scheme was so plausible that he prevailed upon the smelting firm of Moffit & Sargent to give it a trial. It proved to be a great success. In a short time Mr. Bartlett sold his interest in the establishment and his patent right on all the territory west of the Mississippi for $150,000. New and more commodious buildings were subsequently erected, and at the present time lead smelting and white lead manufacturing are conducted on a grand scale. To give the reader some idea of the work now done by this one firm I insert the following figures given me by Mr. J. H. Black, the foreman:

Average amount of ore (*lead sulphide*) smelted per day . .	90,000 lbs.
Average per cent. of metallic lead obtained from same	66⅔ %
Average amount of metallic lead from slag resmelted . . .	14,000 lbs.
Average amount of white lead per day	16,000 "
Average price per thousand for same	$50

It will thus be seen that the average proceeds per day from the white lead alone is $800, or about $250,000 per year. I also learned that the pig lead obtained from the slag furnaces more than paid all expenses of the whole establishment, so that the 16,000 pounds of white lead and the profits on the 90,000 pounds of ore smelted are clear gain.

The smelting furnaces of Joplin city and Short Creek lead mines are all very much the same. They closely resemble the old Scotch hearth excepting instead of having flues three miles long to catch the escaping vapors, as the Scotch hearth is said to sometimes have, the flues are vertical and comparatively low. The furnaces are about twenty-two inches square and nearly the same in depth. A cold air blast, the force of which the workmen can regulate, is sent into each furnace to increase the draught. The bottom part of the furnace is left filled with lead from day to day. The smelting process is briefly as follows: Charcoal and ore, mixed with a little slaked lime, are thrown into the furnace. A heavy blast of air is turned on and roasting is continued for some time, during which the workmen are continually stirring the whole mass, and shoveling out the slag that is formed from the lime and the silica that is mixed with the ore. During the roasting the sulphur of the ore is oxydized into sulphurous oxide, which passes up the chimney. The lead is oxydized into litharge, or lead oxide. After the stirring has been continued for a few minutes the blast is almost entirely turned off, fresh charcoal is added, and the whole is heaped up at the back side of the furnace where it is left for a few minutes. The lead oxide formed is thus brought in contact with carbon which deprives it of its oxygen, leaving metallic lead

which flows off through the grooves in the iron hearth, and is finally caught in appropriate vessels.

The smelters at the white lead works are the same as at other places with one exception. Here comes the patented process. The furnace chimneys are so built that they all lead into a very large sheet iron pipe about three feet in diameter. Everything that passes up the chimney is conducted into this large pipe, which is about 200 feet long. At the other extremity of this piping is a large brick building technically called the "blue room." This building is about 100 feet long and 50 feet wide. It is two stories high, the upper story being about 35 feet while the lower one is but 12. In the upper story, hanging vertically, are 772 cylindrical woolen bags about fifteen inches in diameter and 32 feet long. In the lower story, running the entire length of the building, are four rows of "hoppers," so called from their resemblance to grain hoppers in flouring mills. The top of each "hopper" is about ten feet square, and is fastened to the under side of the second floor. The woolen bags in the second story open directly into these hoppers, the bottoms of which are opened and closed at pleasure by appropriate slides. All of the condensed vapors, mixed with a good deal of soot, having traversed the large pipe are caught by the woolen bags from which it falls directly into the "hoppers" below. After a sufficient amount has been collected—which requires about two weeks time—the slides at the bottom are drawn and the mass runs out upon the floor. This mixture is as fine as flour. It consists mostly of soot and lead sulphate; a small per cent is lead carbonate. The black soot gives the whole mass a blue color, hence the name "blue room." From this room it is taken to the slag furnaces where it is mixed with slag from the smelting furnaces and again subjected to an intense heat. Fluor spar (*calcium fluoride*) is from time to time added as a flux, the slag being a basic silicate.

The flues of the slag furnaces lead into a small brick chamber, the walls of which are six feet thick. On account of the great heat in this chamber its walls are lined with fire-brick. From it the vapors are forced through long pipes similar to the one which connects the smelting furnaces with the "blue room." From these pipes it is led into a large building called the "whiting room." This building is arranged very similarly to the "blue room" excepting that there are commodious arrangements for catching the white lead when it is run out from the "hoppers." The first impression upon entering this room is that one is in a large flouring mill; everything seems to be covered with flour. From this room the white lead is packed for shipment. The whole scheme is a grand one. Chemically, there is nothing new about it; mechanically, it is entirely novel.

In the process of smelting a portion of the metallic lead is vaporized. Subsequently this vapor is oxydized, and, being in contact with so much sulphurous oxide, the heat being very great, lead sulphite is formed which is soon oxydized into sulphate. In the slag furnace the whole is again reduced to metallic lead, but, on account of the superior heat of this furnace—the fire being made from coke—the greater portion is again vaporized and oxydized. The temperature is so high that the formation, or even the existence, of the carbonate is impossible,

while the contact of lead oxide with sulphurous oxide in the presence of free oxygen is favorable to the formation of lead sulphate. The brick chamber above described also plays an important part. It helps to maintain a high temperature until the whole of the carbonaceous matter is completely oxydized, thus preventing the passage of soot into the "whiting room."

This, then, is the one and only difference between the Joplin City white lead and other white lead of commerce. The one is the sulphate of lead, the other is the carbonate.

As before stated, the white lead alone is an actual saving of about $250,000 per year. This is the only establishment of the kind in the world. Within the last few months Mr. Moffit has refused a million dollars for his works. He could find no better investment for his money, and why should he sell? He holds the right to establish other works at such high figures that none have thought it prudent to invest.

I believe Mr. Moffit has never carefully considered the great wrong he is doing the world by withholding a process by which so much might be saved, not made, but *saved* from actual loss. At horse-racing and at cards money is not lost, but only passes from one hand to another. The same is true of many *un*necessaries of life. But here there is an actual loss. The fumes of sulphur and of lead that pass up the chimney can never be regathered. At the other smelter at Joplin City and the one at Short Creek alone, this loss amounts to more than $1,000 per day; enough to feed all the hungry and clothe all the poor in the States of Missouri and Kansas. In other lead mining regions the loss is proportionally great. One thousand establishments of this kind would *save* enough to bear all the expenses of our government.

SIMPLE TESTS FOR WATER.

The following simple directions, by means of which any sample can be examined as to its suitability for use or otherwise, are from Napier's Art of Dyeing:

To ascertain if water is hard or soft.—Procure a small quantity of soap dissolved in alcohol (soap solution for this purpose can be obtained from any operative chemist), and let a few drops of it fall into a glass of the water to be tested. If the water becomes milky it is hard, but if little or no milkiness results, the water may be said to be soft.

Test for acid.—Take a piece of *blue* litmus paper (unsized paper stained with litmus), or paper stained with syrup of violets or scrapings of radishes, and immerse it in the water to be examined. If any free (uncombined) acid is present in the water the paper will become red. If a little lime water, added to the sample causes a white precipitate to take place, the acid is carbonic acid. If dark blue paper, such as is wrapped around loaves of sugar, be converted to red by immersion in the water, the acid is a mineral acid.

TESTS FOR ALKALIES OR ALKALINE EARTHS.—Take a piece of *red* litmus paper (blue litmus paper that has been reddened by means of vinegar or other weak acid), and immerse it in the water. If the blue color of the paper is restored then the water contains either a free alkali or alkaline earth. If the blue color disappears from the paper after a short exposure to the atmosphere the presence of "volatile alkali" (ammonia) is indicated. If a little syrup of violets is added to water which contains a free alkali or alkaline earth it will become green.

TESTS FOR IRON.—To a glass of the water add a few drops of infusion of nutgalls, or suspend a nutgall in it, by means of a thread, for twenty-four hours. If iron be present the water will become of a dark brown or black color. Yellow prussiate of potash (Potassium Ferrocyanide) is a still more delicate test for detecting iron, If a crystal, or a drop of its solution in water, be added to a glass of water containing iron, it will immediately become of a blue color.

TEST FOR CHLORIDES AND SALTS OF HYDROCHLORIC ACID.—Let a few drops of nitrate of silver solution fall into a glass of the water. If a milkiness be produced, which disappears on the addition of a little ammonia solution, it may be concluded that chlorides or some salts of hydrochloric acid are present. (Hydrochloric acid was formerly called muriatic acid). Chloride of calcium, chloride of sodium (common table salt), and chloride of magnesium are most commonly to be met with in spring water.

TEST FOR MAGNESIA.—Take a quantity of the water and boil down to one-twentieth part of its bulk. Drop a few grains of carbonate of ammonia into a small glass of the water, and add a small quantity of phosphate of soda; if any magnesia be present it will fall to the bottom of the glass as a white precipitate.

For this experiment the carbonate of ammonia must be in a *neutral* state; if exposed to the air this salt rapidly becomes acid.

TEST FOR FREE LIME.—Into a glass of the water drop a crystal or two of oxalic acid. If a precipitate takes place, and if another glass from the same sample becomes milky upon blowing air from the lungs into it through a quill or glass tube, the presence of free lime or baryta may be inferred. The latter has never been found *free* in water.

TEST FOR CARBONIC ACID—Take a quantity of the water and add to it an equal quantity of perfectly transparent lime water. If carbonic acid be present, either free or combined, a white precipitate immediately appears, which, on adding a few drops of hydrochloric acid, is dissolved with effervescence.

TEST FOR ANY COMBINATION OF SULPHUR.—Put a little mercury into a vial filled with the water to be tested, cork it, and let it stand for a few hours. If the surface of the mercury has acquired a black appearance, and a blackish powder separates from it on shaking the vial, the presence of sulphur may be inferred.

TEST FOR LEAD.—To a little of the water in a glass add an equal quantity of sulphureted hydrogen solution (water impregnated with hydrogen sulphide gas). If lead be present the water will assume a dark brown or blackish tinge. Lead may also be detected by adding a little of a solution of sulphide of potash, or sulphide of ammonia; a similar effect will take place if lead be present.

TEST FOR COPPER.—Immerse a polished plate of iron in the water to be examined, and let it remain for a few minutes. If copper be present, the plate of iron will be coated over with copper. A few drops of ammonia solution will turn water containing copper a dark blue color.

For all domestic purposes soft water should be preferred, and that which is clear and with little or no taste. But mineral water (water in which mineral matter is dissolved) is less dangerous than that in which organic and animal matter is contained, as this is the common source of most of our infection diseases—typhus, scarlet-fever, etc. One of the readiest and simplest tests for ascertaining if water is free from organic pollution is to cork up a small bottle nearly full of it, in which a piece of lump sugar has been put. If, by thus excluding the air and letting it stand in the light for two or three day, there is not a milky cloud, but the water remains clear, it may be considered free from the phosphates which are always present in sewage water.—*Boston Journal of Commerce.*

CONCERNING FLUORINE.

It was known nearly two hundred years ago that glass could be etched by exposing it to the fumes produced by the action of sulphuric acid on the mineral called fluor-spar; but it was not until the present century that the nature of the chemical reaction in the process was understood. Until the time of Ampère's investigations, in 1810, it was supposed that the acid attacking the glass was an oxygen compound; but that chemist showed, as Davy subsequently did, that the acid was analogous to hydrochloric acid, being a compound of hydrogen with an element existing in the fluor-spar in combination with calcium. This element was named *fluorine*, and the fluor-spar, formerly known as fluate of lime, was designated as fluoride of calcium.

This fluorine is interesting from the fact that (setting aside certain "new metals" whose oxides have been "discovered" within the last few years, but whose existence is still hypothetical) it is the only element that has not been isolated. Many attempts have been made to obtain it in its simple form, but without success.

It is easy enough to decompose its compounds, but impossible to prevent it from immediately entering into new ones. It attacks glass and the metals, so that the chemist is at a loss to find a material for vessels in which to prepare or confine it. It unites at once with platinum, which is proof against so many chemical agents. Davy heated dry fluoride of silver with chlorine gas in a platinum vessel, and got for his pains a fluoride of platinum. He tried the same experiment in a glass tube, and obtained chloride of silver, but the released fluorine attacked the glass, entering into combination with its silicon. For this latter element it has an extraordinary affinity, and its action upon glass is due to this fact. Glass is a silicate, or a compound of silicic acid with soda, lime and other metallic oxides. The fluorine decomposes the silicic acid (SiO_2), and forms with the

silicon the volatile tetrafluoride of silicon (SiF_4). Davy suggested that vessels of fluor-spar should be used for the decomposition, and the experiment has been tried; but the fluorides used were not perfectly dry, and the provoking element united with the hydrogen of the water to form hydrofluoric acid. A German scientist heated iodine with fluoride of silver in a glass tube and said he obtained iodide of silver and a colorless gas, which he supposed to be fluorine; but the English chemist Gore, who investigated the whole subject most carefully, found that perfectly dry fluoride of silver is not decomposed under a red heat by chlorine, bromine, or iodine; while if a higher temperature is employed, a fluoride of the metal—platinum, gold, silver, or whatever the vessel may be made of—is formed. If tubes of graphite or charcoal are used, a fluoride of carbon is obtained. The difficulty of making vessels of fluor-spar adapted to the purpose has prevented further experiments with that material; and for the present the chemists have to confess that they are baffled in all their attempts to isolate this singular element.

Fluorine is also unique among the elements in not combining with oxygen. It is remarkable that, with its powerful affinities for so many other elements, it should be utterly indifferent to one which is equally omnivorous in its chemical appetite.

It has just been announced by foreign journals that Loew has discovered the presence of free fluorine in a certain variety of fluor-spar, found at Wolsendorf in Bavaria. This spar is dark violet in color, and has a peculiar odor, which scientists have attempted to explain by various theories, but not very satisfactorily. Loew came to the conclusion that the odor might be due to free fluorine; and, to test his hypothesis, he ground a kilogram of the Wolfsendorf spar with water containing ammonia, using small portions at a time, the filtrate and wash-waters from the earlier being used with the later quantities. The last filtrate was mixed with sodium carbonate and evaporated; the residue treated in a platinum capsule with sulphuric acid, and, covered with a watch glass, kept at 40° to 50° C. for a long time. On examining the glass it was found to be considerably corroded. Since fluor-spar is not entirely insoluble in water, the experiment was repeated, using the inodorous mineral. The result was so exceedingly feeble as to dispose entirely of this objection to the former result.

Since the odorous spar contains cerium, Loew believes that the free fluorine is produced by the spontaneous change of ceric fluoride into cerous fluoride and fluorine. We shall want, however, to know that his experiments have been repeated and verified by others before we believe in the free fluorine or accept this theory of its origin. It would certainly be curious if an element which chemists have made so many unavailing attempts to isolate is really found free in nature under their very noses. Even if it is, the smell of it may be all that they will get in any attempt to collect and examine the gas. We shall see what we shall see, as the pious Turks say.—*Boston Journal of Chemistry.*

"IRON SPONGE" FOR GAS PURIFICATION—A NEW INDUSTRY.

Iron sponge is a term quite unfamiliar to the average reader, although the manufacture of that article is now one of established industries of this city, and it is shipped from this point to almost every state and territory in the Union.

For the benefit of the uninitiated in the manufacture of gas we will explain the nature of the new product and its uses.

Coal gas, after being washed and condensed, remains heavily charged with impurities in the form of sulphuretted hydrogen, ammonia and carbonic acid, which must be extracted before the gas is fit for consumption, otherwise the odors emitted by the gas while burning would be unbearable.

To remove these impurities lime has— until within the last three years—been universally employed, being considered the cheapest and most effective absorbent, although its use entailed many disadvantages. As it could be used but once the rapid accumulation of "spent lime" with its accompanying odors—familiar to all persons living near gas works—necessitated hauling the same outside the city limits, in many places being an expense of no little importance.

Various experiments were made by those interested in the manufacture of gas to find an absorbent equaling lime without its disadvantages, and success was finally attained some three years ago.

Iron sponge—the term given the successful rival to lime—is obtained by treating oxides of iron in contact with carbon at a suitable heat with complete isolation from the atmosphere, and its peculiar spongy texture is caused by the loss of the volatile matter which, separating from the ore, leaves minute cells and spaces throughout its entire mass, rendering it extremely sensitive to chemical action.

After being used and becoming thoroughly saturated with impurities, it is exposed to the atmosphere for two or three days, which thoroughly revivifies it, and it is again ready for use; the same material being used over and over again for the period of from one to three years, depending upon the condition of the works, character of the coal used, etc.

The advantages claimed for iron sponge over lime are: greater economy, saving of labor, odors, etc., and it would seem not without reason, for since its introduction into the gas works of this city it has been adopted in Philadelphia, Cincinnati, Chicago, St. Louis, Kansas City, Sacramento, and scores of other works of less importance, throughout the country.—*American Manufacturer.*

PHYSICS AND ENGINEERING.

COMPASS SURVEYING.

BY FRANCIS E. NIPHER, PROFESSOR OF PHYSICS IN WASHINGTON UNIVERSITY, ST. LOUIS, MO.

Those who have had to do with the survey of land by means of the ordinary compass, do not need to be told that the field work is often attended with great difficulties. One of these difficulties arises from the daily swing of the needle. In the morning at about half past seven o'clock, the north end of the needle is farthest to the east. It then moves to the west, reaching its greatest western elongation at about one or two o'clock P. M. The average daily change in the position of the needle between these hours is fourteen minutes, or practically a quarter of a degree. This angle of swing varies, however, between eight and twenty minutes, and one can never predict what the daily swing of the needle will be. Hence, if a section line should be run in the morning, and the surveyor should attempt to retrace the same line in the afternoon, he might find the final ends of the two lines twenty feet apart.

In addition to the daily change of the needle, it is also known that the average position of the needle is changing each year. The annual change at St. Louis is now about two minutes a year, but the annual change is itself subject to change according to a law which is as yet unknown. It is assumed that the annual change is the same over large areas of the country, but it is not known that this assumption is true. On the contrary, observations made at St. Louis and near Washington, in Franklin county, during the last fifty years, lead to different values for the annual change. In addition to these changes, which are due to a change in the magnetic condition of the earth, there are other errors which are due to a change in the magnetic condition of the needle. If the true variation of the needle be known at any moment, and two compasses be set for that variation, and with the needles set on the zero of the circles, the sights of the compass would not point exactly in the same direction, nor would either of them point north and south, except by merest accident. If either compass should at some later date be again set down at the same point, adjusted again to the true variation, it would not, in general, point in the same direction as before. These differences are caused by a change in the position of the magnetic axis of the needle. The *magnetic axis* of the needle always points in the direction of the magnetic meridian (when the needle comes to rest under the influence of the earth's force alone), but the magnetic axis does not in general coincide with the geometrical axis of the magnet, and its position is changed by the shocks and jostling incident to transportation and use. These changes in the position of the

magnetic axis of a needle, are always greatest with new needles, or those which have been freshly magnetized, and hence a needle should never be remagnetized unless it is absolutely necessary. If a line be run with an old needle, and the needle is then remagnetized, the compass set to the same variation will not in general run the same line.

These difficulties in compass surveying, are the main source of the constant litigation in regard to boundary lines, and as land becomes more valuable, these quarrels will become more frequent and more expensive, until some rational method of treatment is adopted. It is not saying too much to assert that in each county there is enough money wasted each year in useless litigation over boundary lines, to pay for the permanent establishment of a true north and south line, which would at once settle most of these difficulties. This meridian line being once determined by astronomical methods, and properly marked on stones, and made authoritative by proper legal enactment, would serve as a standard for all time. Then if two surveyors should disagree, it would only be necessary for them to set their instruments on this line placing the sights north and south, and they would find that the two instruments must be set to slightly different variations in order to run a true north and south line. If a surveyor should find that he could not retrace one of his own lines run the previous year, he would find by setting his instrument on the standard line, that owing to a change in the position of the magnetic axis of his needle, he must adjust to a slightly different variation. We should then learn in a short time what the annual change in the variation is at each county in the State and should no longer be obliged to *estimate* this change.

It is certain that all this will be finally done in Missouri, as it has already been done in older States. The only question is, how long will it take the people of Missouri to learn that it will *pay* them to make use of what is well known, and has been practically serviceable in Ohio. It is only necessary for the Legislature to authorize the county courts to employ some competent person to establish such a meridian. There are certainly many persons in the State who are capable of doing such work, and the expense involved is a mere trifle compared with the great benefits to be attained.

The writer desires to say in conclusion, to any person in the State possessing an engineer's transit, that he will at any time send instructions for the determination of the true meridian, provided that the resulting variation of the needle is communicated to him.

THE ISTHMIAN SHIP RAILWAY.

Captain James B. Eads returned to St. Louis on the 9th ult , after a prolonged visit to Europe on business connected with his well-known scheme for building a ship railway across the Isthmus of Tehuantepec. From his statements

In an interview with a reporter of a city paper we cull the following items of interest :

"I visited Europe to look into the question and cost of construction of railroads for the purposes of taking ships out of water and transferring them to railroads, and the best and most economical systems. I examined very particularly the Anderton Barge Lift, by which the Bridgewater Canal and the river Weaver are put in communication with one another. The surface of the canal is fifty-one feet above the river, and, to avoid the use of locks, a section of the canal about 130 feet long is supported on the ends of long, vertical hydraulic plungers or rams, and lowered, with 250 tons of water in it, to the surface of the river, with a canal-boat in it. At the same time another section of the canal, of the same size, supported in precisely the same manner, is raised up with a canal-boat in it from the river and joined to the canal. The operation is done in three minutes. The machinery has been in operation for six years, without entailing a single cent for repairs, and without an accident occurring during that time. The Government of France had the work examined critically, and has contracted with the builders of it to apply the system upon one of the French canals. Then instead of lifting 250 tons it will lift 1,000. The Belgian Government has also investigated the subject, and has ordered a similar lift for one of its canals to raise 1,300 tons. The engineer who designed and constructed the Anderton Barge Lift, has written to me proposing to erect works at each end of the ship railway, on a plan somewhat similar, by which ships of any size may be raised in thirty minutes, forty-six feet high, ready for the journey over the railway. The plan which they propose is now in operation in Bombay, where a weight of 10,000 tons has been lifted in this way. Another similar dock is in operation at Malta and another at the Victoria Docks, London. The work is designed by Edwin Clark, who was Chief Assistant Engineer to the celebrated Robert Stephenson. The method proposed for the Ship Railway does not contemplate raising vessels in pontoons of water as at Anderton. In the Malta and Victoria Docks many vessels have been taken out with full cargoes on board. They are taken entirely out of the water —dry—on an iron platform which is suspended between two rows of hydraulic presses. On the platform a section of the ship railway would be laid to correspond with the railway on shore. When the platform is up the ship car would be run on to it and then the platform would be lowered down into the water sufficiently deep for the ship to float over it. The various supports necessary to sustain her would be moved up automatically in contact with her keel and bottom, and she would then be raised out of water until the rails on the platform would come in connection with the terminus of the ship railway. This being done, the locomotives to haul her would be attached to the car which would then be started across the Isthmus and lowered into the water at the other side by the same means."

Captain Eads took occasion to correct the impression that he designed carrying the vessels over in tanks of water on wheels.

"I never advocated any such method, as it would be useless expense to

transport large quantities of water without pay, from ocean to ocean. With any ordinary care the danger of straining vessels in transit would not be possible. A substantial road bed is an absolute necessity for the success of the Ship Railway. If we had to build over ground that would not sustain it I should excavate a canal through such part of the route and float the ship through that part of it until the solid ground was reached; but we shall have no such ground as this on our route. If but one ship with a full cargo had ever been taken out on a dry dock without injury it would be proof that others could be taken out in the same manner. I have the names of a score of loaded vessels that have thus been lifted out of dock, and in traveling over the ship railway they could not possibly be subjected to as much vibration and jarring as powerful steamships are by the action of their propellers upon going at full speed."

To the question whether the English engineers had faith in the success of the undertaking he replied:

"Yes; I never have met a civil engineer who questioned the possibility of constructing a railway, locomotives and cars by which loaded ships of any size could be carried across the isthmus. In rare instances, I have met civil engineers who doubted whether the ships themselves would bear such usage. Ship building is a branch of civil engineering, and experienced builders of ships are best qualified to judge of the possibility of such transportation being done without injury to vessels. Many of the very best ship-builders in this country and England have given me their written assurances that any seaworthy ship will bear such transportation on a good railway, if ordinary skill and care can be used in adjusting the supports under her.

"As to the economy of transporting freight, my inquiries in England satisfied me of the absolute truth of what I had always contended upon this point, namely, that transportation by ship railway is unquestionably more economical than by canal. The cost of transportation on the ship railway should be much less than that upon the ordinary railroads, for the same reason that transportation on large vessels, barges, steamboats or ships is much cheapened in proportion as we increase the size of such vessels, for the same reason that transportation by rail can unquestionably be greatly cheapened by increasing the quantities which are moved *en masse.* I have no question whatever in my own mind that a ship railway to carry barges of 1,000 tons capacity can be built and operated much more economically between Chicago and St. Louis than by the construction of a canal to float the same sized barges. They could be loaded in the lake, and transported by rail to the Mississippi, and towed down to New Orleans without re-handling cargoes. It has been offered in evidence before the House of Commons, in England, that coal is transported for one farthing or one-half cent per gross ton per mile on English railways, at a profit to the road and defraying the cost of returning the empty cars. I am satisfied that the actual cost of transporting cargoes on a well built ship railway across the Isthmus, a distance of 125 miles, will not cost more than sixty-two and a half cents per ton from ocean to ocean. This would cover the motive power, repairs and maintenance of every kind, including

ages, supplies, and in fact everything except interest on the capital invested. 'o-day they are paying from San Francisco to Liverpool, via Cape Horn, $21 er ton for freight. I saw a number of owners of ships engaged in this trade, nd was assured by them they could well afford to pay one-third of what they eceived for crossing the Isthmus with their ships. This would be $7 a ton, more han ten times the actual cost of transporting ships over the railway when it is nce completed."

Captain Eads seems certain that Congress at its next session will pass his ill, and gives the following reasons why it should be passed: "1. Because no roposition of such novelty has ever been presented to the people before which as so completely silenced ridicule and won the confidence of thinking people. . Because the work is required more imperatively at this time than during any revious period of the world. 3. Because the concession secured by me from Mexico enables me to give to the United States the absolute control of the Isthmus, exclusively in the interest of American commerce. 4. The route lies through Mexican territory, and the railway will tend to develop a greater commercial and ocial intercourse between the two republics, and immensely promote the material nterests of both. 5. It will be almost unanimously supported by the representaives of the Mississippi Valley and the Gulf States, for the reason that it will give o this section of the country, embracing much more than one-half of the total rea of the American Republic, direct communication with the enormous commerce of the Pacific Ocean and the Orient, from which they are to-day completely shut out by the Isthmian barrier. It is not generally known that New York is considerably nearer to the Orient by way of Cape Horn than either New Orleans or Galveston. Finally, I am confident that the bill will be passed by Congress because the proposition is a fair one, and I have received the assurance of more Senators and Representatives that they will support the measure, than I ever received before the passage of any one of the jetty bills, although they were passed by immense majorities in every instance."

In regard to

THE CONDITION OF THE JETTIES

At the mouth of the Mississippi River, Captain Eads assured the reporter that, "There has not been an hour nor a minute in the last two years during which there has not been an abundance of width and depth in the jetty channel, not only for the larger steamers visiting New Orleans, but for those visiting New York. It is asserted that a vessel rubbed the bottom while drawing only twenty-three feet. Vessels will rub the bottom if there was fifty feet in the channel, if they get too far to one side or the other of it. I am not required to furnish pilots, and if they do not find a channel it is their own fault. If the vessel alluded to had grounded at the time named, the captain would have found a twenty-six foot channel, more than 200 feet wide, immediately to the eastward of his ship, and through which there existed at the time a central depth of thirty feet. In only a few instances have vessels grounded by getting out of the channel during the last two years. The Pass is not straight, and long steamers, unless great

care is used by pilots, in ascending are liable to 'take a sheer,' and in such case ground on one side of the channel before the pilot can prevent it, but in no in stance of this kind has there failed to be an abundance of water in the channel and no interruption whatever has occurred by the grounding of such vessels, t the passage of others in either direction. I tried with all the arguments that could use to have the Southwest Pass improved instead of the South Pass, be cause it discharges four times the volume of water, is twice as deep and twice a wide, but the Senate reversed the action of the House in the matter and gave m the little Pass to improve, the Commission of Engineers to whom the matter wa referred having declared that the little one was sufficiently large for the presen and future purposes of commerce. The Pass itself has from twenty-six to thirt feet of water in it, and the law contemplated no improvement whatever in th Pass for reasons just stated. It is ten miles long. The jetties are at the end o the Pass, extending out into the sea two and a quarter miles, and the law doe not require me to maintain any definite sized channel through the Pass at all but expressly provides that I shall be paid $100,000 per annum for maintainin a channel through the jetties, having a central depth of thirty feet and a channe twenty-six feet deep with a bottom width in no place less than 200 feet. Thi latter width has been maintained during the last year and a half without interrup tion, except during four days, when it was diminished to 110 feet in width by th rising of a 'mud lump.' For these four days a proportionate deduction from m compensation was made by the United States, although the contract depth c thirty feet existed at the time through the channel, and the 110 feet of twenty six-foot water was of ample width to have passed the City of Rome with safety The channel is measured every week or two by my own engineers, and is care fully surveyed and measured by the United States engineers whenever they thin it can be found deficient. Their surveys are made without regard to any fixe time, and parts of the channel suspected of deficiency are measured by them tw or three times a week. In addition to this absolute testimony to the falsity c these reports, intelligent people recognize the fact that within two years New O leans has risen from a fourth class exporting port to a second-class one, and n one can cite the instance of a single vessel that has been detained a single minut by grounding in the channel, whether in the Pass or the Jetties.

"I have said and done all I can to secure the improvement of the river. It commerce has now a chaice of all the Atlantic markets of the world through th Jetties and Straits of Florida, and I intend to devote my utmost energies to secu ing for it a choice of the markets of the Pacific by giving the Mississippi River a outlet across the Isthmus of Tehuantepec."

Captain Eads will remain in St. Louis a short time when he will leave fo New Orleans to take the "City of Merida" for Mexico. He will cross the Istl mus to examine the lines surveyed by his engineer during the past ten month and will visit Vera Cruz for the purpose of submitting plans for harbor improve ments at that port.

ARCHÆOLOGY.

PREHISTORIC MAN IN LAFAYETTE COUNTY, MISSOURI.

BY PROFESSOR H. A. REID.*

The relics of the mound-building race, found in this county, are not so numerous nor so rare as the remains of the same people which have been found in a few other counties; yet they are enough to show that the site of the city of Lexington and its vicinity was occupied by the ancient people, probably for a long period of time and in considerable numbers.

MOUNDS.—Mr. George Wilson, of the Lafayette county bank, informed me that when he was a small boy there were three mounds on a part of the premises now owned by the Elizabeth Aull Female Seminary; two of them were dug away when the foundation was made for the house now occupied by President J. A. Quarles of that institution, but nothing was found except a few decayed bones, some beads, and small trinkets of no special significance. One mound still remains in Prof. Quarles' back yard, which I examined. It is a low, weatherworn knoll on the brow of the bluff overlooking the Missouri River, and so nearly obliterated that it would scarcely be noticed except by persons who had some knowledge of or special interest in this class of remains.

In company with Mr. Charles Teubner, of Lexington, I visited two mounds on T. R. E. Harvey's land, about two miles northeast of the city. They were the usual form of oblong knolls, perhaps twenty rods apart, on the brow of the bluff, and commanding a magnificent view of the river and country beyond. One of these mounds is still six feet high and has a recent grave on top of it, but neither of them have ever been opened. At another time, in company with Mr. Teubner and Dr. Sanford Smith, I visited a mound two or three miles southwest of the city on the Odell place. This mound was about seven feet high, and old Mr. George Odell had dug into it from top to bottom some twenty or twenty-five years ago, but found nothing except some crumbly human bones, and that a layer of flat stones had been arranged on the original surface of the ground before the mound was built. These stones we detected *in situ* at one side of the mound where the earth had been washed away by many rains. The stones had been brought from a shelving ledge perhaps a hundred rods distant and part way down the bluffs; but the mound was on the highest point of land in that vicinity, and from its top we could see objects which Dr. Smith, who has lived there about forty years, assured me were twenty-five miles distant up the river, and it is probable that this mound had been used as a signal tower.

* I have been engaged for about four months in preparing a history of Lafayette county for the Missouri Historical Company; and this article is prepared from advance sheets of that forthcoming work.

The foregoing were the only mounds I visited, but a total of fourteen were reported in the county. W. H. Chiles, Esq., reported a group of five mounds about eight miles south of Lexington, on Brush creek where the old Lexington and Warrensburg road used to cross the stream, and that none of them had ever been opened. Ethan Allen, Esq., of the *Lexington Intelligencer*, reported one mound on Wm. T. Hays' place and two on Dr. Wilmot's place, from three to four miles east of Lexington, neither of which had ever been opened.

MOUND-BUILDER'S ART.—I learned of a place about a mile east of Lexington city that was called "Indian Hill" by some of the "knowing boys" of the city, who had often gone there to pick up flint arrow-heads. Two bright lads of this class went with me to the place one day, and after a careful inspection at that time and several subsequent visits, I was persuaded that it had been the site of a prehistoric village. I say "prehistoric" because there is no evidence found in any reports by the earliest French or Spanish prospectors in this region that the Indians had any village at this point. I learned that many pocketfuls of arrow-heads had been found here (within a space of five or six acres), and three or four stone axes also, but no one seemed to have ever noticed the pottery or thought of its having any special significance. I gathered fragments of pottery from time to time until I had specimens bearing over thirty different sorts of ornamentation. In addition to these I gathered three or four quarts of flint chips, broken arrow-heads, and some whole ones, besides other curious specimens. But the most rare and interesting "find" was the lower part of a tiny copper axe, showing the whole blade of the instrument, and remarkably well shaped. It is one and three eighths of an inch across from corner to corner of the blade; then the width narrows a little up toward the handle place, and it is a little flatter on one side than the other, and three-sixteenths of an inch thick. The fragment is broken off below the handle place, and the break is five-eighths of an inch up from the edge on one side and fifteen-sixteenths up on the other side. My first impression was that it had been hammered into shape from a piece of pure copper ore, such as I have seen in great masses from the Lake Superior copper mines; but finally concluded that it had been molded in a crude mold such as "us boys" used to whittle out in pieces of shale (mistakenly called "soapstone"), and then pour in melted lead. In Col. Switzler's History of Missouri there are some very excellent chapters on "Prehistoric Man," written by A. J. Conant, of the St. Louis Academy of Sciences, and on page 108 he says:

"It has been stated, and often repeated, that they [the mound-builder folk] had no knowledge of smelting or casting metals, yet the recent discoveries in Wisconsin of *implements of copper cast in molds*, as well as the *molds themselves*, of various patterns, and wrought with much skill—prove that the age of metallurgical arts had dawned in that region, at least."

It is a well established fact in archæology that the prehistoric peoples of America had a very wide range of intercommunication and rude barter; and I think it altogether probable that the fragment of a copper ax which I found in con

nection with flint chips, arrow-heads, ancient pottery, etc., on the site of an ancient Mound-builder village at Lexington, Missouri, was molded by the ancient copper-workers referred to by Mr. Conant, as above quoted. It was too small for any practical use as an axe or weapon, but the rich shiny quality of polished copper would render it as precious a metal with a primitive and rude people as gold is with our modern nations; and hence it is presumed that this specimen was probably an amulet or else the token of authority owned by some barbaric chief.

Another curious relic which I found there was a piece of brown hematite, wrought or flaked off into the shape of a box turtle, one and one-half inches long, one and three-sixteenth inches wide and one-half inch deep from top of the rounded back to the flat bottom part. It is so manifestly flaked into its present shape that there cannot be any mistake about it; and the bottom or flat side is worn very smooth. My conclusion is that it was a game piece of some sort, to be moved around on a marked robe, or on the ground, something after the fashion of checkers, morris men, etc., either for pastime or gambling purposes. There was found, a mile or more from this ancient village site, and sent to me by Col. John Reid, of Lexington, a ball of flinty hornstone about as large as a medium-sized Osage orange, and I think from its appearance of wornness on one side that it was made by the stonefolk and used as a muller or pestle for triturating their parched corn, roasted acorns, etc., and probably also for pulverizing red, yellow, and other colors of ochre to mix their paints for war parties, dances, feast days and grand occasions. Mr. Jackson Cox, of Sniabar township, plowed up in his field a very fine specimen of ancient stone pipe and sent it to me. It is of ovoid form, with a groove and creases worked very neatly around each way from the stem hole; its material is a heavy, compact dirty-blue variety of pipestone; the bowl cavity is relatively small, and that and the stem-hole are both of a uniform sharp taper, as if the maker did not know how to make a hole as large at bottom as at top, and the groove, therefore, may have been intended to hold in place a thong by which the pipe stem was held into its socket.

THE TEUBNER COLLECTION.—Mr. Charles Teubner, of Lexington, Missouri, has a collection of mound-builder relics numbering over 2,300 specimens in flint, such as arrow-heads, spear-heads, javelins, daggers, bird-darts, drills, reamers, fish-spears, shovels, hoes, scrapers, knives or lances, game pieces, etc., etc. The materials represented in these specimens are flint, hornstone, agate, chert, chalcedony, hematite, slate, milky quartz, and vitreous or glassy quartz crystal. Among these are over one hundred specimens known as bird-darts, being perfectly wrought and finished arrow-heads, less than an inch long—some very tiny ones, only half an inch or five-eighths in length. These are supposed to have been designed especially for shooting small birds of brilliant plumage, the feathers of which were used by some tribes in making a rich and gaudy kind of cloth, which exceeded in princely gorgeousness and splendor the costliest silks and velvets known to European courts. It was made in about the same way that some good housewives nowadays make most elegant rugs, by knitting common store twine and looping a small shred of silk fabric into each stitch, and when fin-

ished shearing the slired ends all to an even length. However, the feathers would have to be worked in so as to make their plume ends come right, without trimming. Garments of this sort of fabric were found by the Spanish invaders in Peru, Mexico, and as far north as an Aztec village of sun-worshippers where the city of Vicksburg now stands.

About nine hundred specimens of Mr. Teubner's collection are arranged on black oil-cloths so as to form five life-size figures, as follows: No. 1, Indian with battle ax, raised in the act of striking a savage blow. This figure or chart is composed of 181 flint arrow and spear-heads, so arranged as to depict the Indian physiognomy, costume and action with great vigor and lifelikeness. No. 2, Indian with drawn bow and arrow, full life-size, and the Indian's redness of face, even, is artistically represented by using red or coppery tinged flints, for that part. This design is composed of 192 pieces. No. 3, A deer running. This is a companion-piece to No. 2, and contains 93 flints, beside a small pair of deer horns. No. 4, Indian smoking the peace-pipe. This chart contains 147 flint specimens. No. 5, Indian squaw and papoose. This is the masterpiece of all; it contains 296 flints, so exquisitely arranged that the woman's moccasins, frilled skirt, flowing hair, and nursing breast are perfectly represented; the child's figure is very perfect, even every finger and toe being plainly seen; and by a marvelously skillful use of the different shapes and colors of the arrow-heads, an expression of glee or laughter shows in the face of both mother and child as she stands playfully tossing the little sucker as high as she can reach.

The specimens of which these figures are composed were all collected in Gasconade and Franklin counties, Missouri, during the years 1873–74–75, by George H. King, Esq., now of Kansas City, but who was then school commissioner of Gasconade county. He made the charts, and had them displayed in the Missouri building at the Centennial exhibition at Philadelphia, 1876. Mr. Teubner afterward bought them and added them to his Lexington collection. He has specimens from Lafayette, Gasconade, Franklin, Pettis, Montgomery, Boone, Warren and Jackson counties in Missouri, and also from the States of Kentucky, Ohio, Indiana, Virginia, Maryland and New York. Besides the flint specimens, there are grooved stone hammers and axes weighing from twelve ounces to five pounds. Two of these are of brown hematite (iron ore), almost as heavy and hard as real iron. There are also stone bark peelers, skin-dressers, corn-pestles, paint cups, game discs, pipes and various other tools, trinkets, amulets, etc. I suppose there are two or three other larger private collections in the United States than this, but I doubt if there is another one which contains such a great variety of the rarest forms in ancient flint work, and so many exquisitely finished and perfect specimens. He has samples in every material I have ever seen used for arrow-heads except obsidian or volcanic glass. Mr. Teubner has been over twenty years making his collection, and still pursues it with unabated zeal and perseverance, aiming ultimately to give the city of Lexington and State of Missouri the honor of having both the largest and best collection of the kind in the United States, outside of the Smithsonian Institution at Washington.

THE ART OF FOUNDING IN BRASS, COPPER AND BRONZE.*

BY EDWARD TUCK.

The origin of the art of founding can only be a matter of speculation, extending as it does so far back in the past history of the race, a history to a very large extent wrapped in obscurity and mystery. But the marvelous results of the various operations and the immense importance they have to mankind, have caused many in ancient times to assert that the art was communicated to man by the gods. Some, and with a larger share of truth, consider that man, finding by accident that certain minerals by the force of fire yielded a metal, repeated the experiment on other minerals, finding out other metals, and thus ultimately all the differing forms in which they exist in the earth. As late as 1762 a large mass of mixed metals, composed of copper, iron, tin, silver, was melted out of the earth during the conflagration of a wood accidentally set on fire, and various ancient historians speak of metals having been melted out of the earth during the burning of woods in the Alps and Pyrenees.

Copper is occasionally found in nature in a metallic state so pure as to be used for manufacturing purposes, either for making articles of copper or alloys. There are examples of this in the mines of Lake Superior in North America, where large masses of copper have been found weighing several tons. It may, therefore, be considered quite possible that quantities of copper were found in the earth in the olden time, so that the ancients could possess the metal without the necessity of smelting. But, however, this fact must be stated, that where a mass of copper is found embedded in the earth at any depth it would require a greater amount of skill and mechanical knowledge to get this into working operations than to smelt the ore. Such a mass could not be broken up like stone, but must be cut, and therefore would require tools of particular hardness, and other mechanical appliances, to obtain which requires a greater and more refined knowledge of metallurgy than smelting copper from the ore.

But whatever or wherever may have been the origin of the art, it is quite certain that it originated at the very earliest period of man's history and has gone down with him along the stream of time to this age. It has had, as all arts have had in varying ages and nations, its rise and decline, which make the investigation of its history a somewhat difficult task. Still, by the aid of researches which have been made amongst the ruins and relics of past buried ages, we have been able to gather together some facts which help us to form something like a history of the art, very imperfect in many points, yet enabling us to form some idea of the methods of working and the means by which certain results which are matters of wonder to us even now were accomplished.

We have, it is true, in these modern days advanced far, very far, in the metallic arts; but in the great facts and principles we are no farther than the men of

* A summary of the second prize essay of the Worshipful Company of Founders, 1880–81.

the past. In the matter of tools and means of production we have advanced so that we may produce in one week as much as they did in one year. But still the fact remains, *they accomplished the work*, and in the especial matter of bronze we have not yet reached the height of perfection to which certainly they attained.

Pliny and other ancient writers are very far from being correct in their descriptions of the manufacturing processes; and even the translators of their works have added to the confusion, either through ignorance, or on account of the poverty of the original language in technicalities, as we find brass in one place, white copper in another, copper in a third, all referred to indiscriminately, whether referring to pure copper, the alloys whitened by the addition of lead, tin, or any other process; although Pliny certainly does describe more correctly the casting of bronze, for he says: "The mass of copper was brought to a liquid state, then was thrown into a third part of old bronze and 12½ per cent. of plumbum argentarum," *i. e.*, tin and lead in equal parts. We shall, therefore, trace the history of the art of founding, so far as we have been able to gather it from the past history of ancient times and the researches into and about the buried cities, and trace its course down through the ages to the present time.

The oldest reference we find in Holy Writ is in the Book of Job (the oldest work extant), Ch. xxviii. 2, "Brass is molten out of the stone." In the original Hebrew the word is *Nechosheth*, meaning literally copper. This must be so, as brass, being an alloy and not a pure metal, is not smelted, or, as it is put here, "molten out of the rock." The next reference is in Genesis iv. 22; "Tubal Cain, an instructor of every artificer in brass and iron." The same word *Nechosheth*, is used here, literally copper; but seeing that copper is a difficult metal to work, we believe that the alloy of copper bronze is really meant. We incline to this belief because there is only one other reference to copper in the Old Testament (Ezra viii. 27): "Two vessels of fine copper, precious as gold." And here the same word is used. We find that tin, which mixed with copper forms bronze, certainly was known to the ancient Israelites, as in connection with the spoil taken from the people of Midian 1452 B. C. (Num. xxxi. 22) they are commanded by Moses to purify the silver, brass, iron, tin, and lead by passing it through the fire. (Moses appears here to mention all the metals then known.) Whether the tin came from India or not there is no sufficient evidence to prove, but it appears certain that the productions of that land were known in the earliest times, by "the gold of Ophir" being mentioned in Job.

If the Phœnician ships did not actually sail to India, its productions arrived partly by land through Arabia, partly through more distant marts established midway from India by the merchants of those and later times; and we have evidence of their having arrived in Egypt at the early period of Joseph's having been taken there, by the spices which the Ishmaelite caravans were carrying to that land. And the amethyst and other objects discovered at Thebes, of the time of the third Thothmes and succeeding Pharaohs, and which must have been brought to Egypt, argue very strongly that the intercourse was constantly kept up. Bronze

composed of tin and copper, was found in Egypt of the time of the sixth dynasty, 2,000 years B. C.

The first work of art of which we have any details in Holy Writ is the Ark made by Moses, and generally called "the Ark of the Covenant." It was also the first work performed by the Israelites as a nation. A large portion of the works in connection with this are of pure gold beaten out with the hammer; and although these show mechanical skill of a very high order, they are outside the scope of our paper.

We read (Exodus xxxviii. 8), "And he (Moses) made the laver of brass, and the foot of it of brass, of the looking-glasses of the women," etc. The word translated "foot" should be, as given in the margin, "cover." This laver, or large basin, in which the priests were to wash, must have been a large work to cast, and it shows a complete and accurate knowledge of the different sorts of bronze for different purposes that the cover should be made of the mirrors of the women, brought by them out of Egypt, and which, containing about one-third more of tin in the alloy, constituted speculum metal. So that the cover of this huge washing basin formed, when raised, a mirror in which the priests could examine themselves before approaching the altar. There were besides this many other articles used in the erection of "the Ark of the Covenant" made of bronze. Dean Prideau gives as the weight of bronze used, 10,277 pounds troy weight. The entire weight of the articles made in the three metals, gold, silver, and brass or bronze, was 14 tons 2 cwt. No one can read over the narrative of that undertaking, viewed independently of the adverse circumstances of the Israelites, wanderers in the wilderness, without perceiving that many amongst them possessed great skill; some had most probably been amongst the highest class artisans of Egypt. The ease with which these elaborate works connected with the Ark, as well as the Golden Calf and the Brazen or Bronze Serpent, were produced, show that they had not been employed solely in the labor of brickmaking whilst in Egypt, but that in all probability many of them were working men in the Egyptian foundries and other public works in which metal articles were manufactured.

Bronze being a mixture of copper and tin in variable proportions, every variation produces a bronze of different quality, more or less suitable for different purposes. One quality will have great hardness and very be brittle—another hard and flexible; one gives a bright reflecting surface when polished, suitable for mirrors—another is famous for its sonorous quality, and is therefore suitable for bells, gongs, etc. Before these properties and differing qualities could have been found out some length of time must have intervened, as such knowledge of practical facts could not have been obtained until society had gained a considerable advancement in the arts. We are able to show by analyses that have been made of the bronze of the Egyptians and other ancient nations, that it was of such varied qualities, requiring a great amount of knowledge and practical skill as well as pure materials. Consequently these ancient people must have attained the knowledge before they could procure the varied articles. A chisel found by Wilkinson in an Egyptian quarry gave copper 94.0, tin 5.9, iron 1=100. A dagger, analyz-

ed by Klaporth, copper 91.6, tin 7.5, lead 0.9=100. Bowl or dish from Nimroud, copper 89.57, tin 10.43=100. Bell analyzed by Dr. Percy, 84.70, tin 14.10. Thus showing where sound is required the amount of tin is increased, where strength is required the amount of tin is decreased. Dr. Percy found also a small casting, in the shape of the fore-leg of a bull, forming the foot of a stand consisting of a ring of iron standing upon three feet of bronze. A section made disclosed a central piece of iron over which the bronze had been cast. The casting was sound and the contact perfect between the iron and the surrounding bronze, and it was quite evident on thorough inspection the bronze had been cast round the iron, and not the iron let into the bronze. The analysis gave copper 88.67, tin 11.33. No perfectly satisfactory conclusion can be arrived at whether the iron was employed because required in the construction or to economize the more costly metal—the bronze required for the ornamental purpose; we are inclined to the former in this case. Sir Henry Layard speaks of the bronze vessels, which he supposes to have been used in the religious ceremonies, as especially deserving of attention, as demonstrating the skill of the Assyrians in their treatment of bronze. One specimen may be particularly noted: "A thin hollow casting in bronze which was attached to the end of one of the arms of the throne. This casting had evidently been chased, and for that purpose must have been filled with some substance, such as pitch, which is used at the present time, as in the interior was some black compound which was like pitch and left an earthy residuum, and was probably a mixture of asphaltum and earth." It is quite evident that the Egyptians at the time the Children of Israel were in captivity amongst them, and even long before that period, were very skillful in working the metals, especially bronze. We have no exact idea of the form of the furnaces or materials used in their construction, but that they had great facility in constructing such furnaces is evident from the short time taken by Aaron to cast the calf or bull when in the wilderness. So we may presume that the Hebrews had been many of them laborers with the skilled artificers of Egypt, and, when leaving, had taken away their tools and the knowledge of the art in which they had worked with them. But whether the same or similar means were adopted for overcoming the difficulties of founding as in the present day, this fact remains, the difficulties were overcome, and the metals then known were used in abundance and as pure as we now have them.

Wilkinson, in "Ancient Egypt," gives the figure of a smelting or melting operation from one of the ancient monuments. The furnace seems only a heap of fire on the surface of the earth, and the bellows are two large bags filled with air, upon which a man is standing with a foot on each bag, the aperture of the bag being connected with a pipe leading into the fire. While the man appears to be putting all his weight on one bag to compress the air out into the fire, he is lifting up his other foot, and at the same time the upper fold of the other bag by a string in his hand, by which the bag is again being filled with air. This apparatus is no doubt both simple and rude, and if it refers to the ordinary metallurgical operations performed by the nation, one could hardly suppose that cast-

ings of any great size could be obtained except with much difficulty. Still it shows that the methods adopted for getting an intense heat were similar to ours, viz: by bellows or blowing.

Ordinary bellows are said to have been invented by Anacharsis the Scythian, but that must have been long subsequent to this period. Very little can be discovered to illustrate the means employed in metallurgical operations from the objects found in the excavated tombs, or from the paintings beyond the use of the blowpipe and the forceps, and the concentration of heat by raising cheeks of metal round three sides of the fire in which the crucibles were placed. Homer notices "that the Egyptians and other Asian workmen excel in the manufacture of arms, rich vases, and other objects inlaid and ornamented with metal." Herodotus and Helanius both say, "the Egyptians drank out of bronze goblets" We find that statues, musical instruments, implements of all kinds, adzes, axes and chisels, articles of furniture, bedsteads and footstools, and many other domestic utensils were all made of bronze. Also biers, on which bodies were placed after death. The Egyptian vases are numerous and to be noticed for beauty of form and the design ornamenting them, as well as for the superior quality of the material. Those used in the service of the temples were especially beautiful. One found by Mr. Salt had an elastic spring to the cover, and the nicety with which it is fitted exhibits evidence of great skill in the workmanship.

The sistrum was *par excellence*, the sacred musical instrument, and was usually of bronze or brass, sometimes inlaid with silver. One now in the British Museum is entirely of bronze, having a hollow handle closed by a movable cover of the same metal. The cymbals, or clappers, which when struck together emitted a sharp metallic sound, were of mixed metal, probably copper and silver, and in shape much resembling those of modern times.

It is not known at what times the ancient Egyptians began to cast statues and other objects in bronze, or how long the use of beaten copper preceded the art of casting. Many bronzes, however, have been found of a very early period. A cylinder with the name of Papi, of the sixth dynasty, has every appearance of being cast, and other bronze implements of the same age bear still stronger evidence of having come from a mould, all of which date more than 2,000 years before our era. The Egyptians, too, appear to have possessed the secret of giving to their cast bronze blades a certain degree of elasticity, as in the dagger now in the Berlin Museum, which probably depends for this property on the just proportions of the peculiar alloys used in its manufacture, as well as on its mode of having been hammered. Another remarkable feature in this bronze is the resistance it has offered to the effect of the atmosphere, continuing smooth and bright though buried for ages, and since exposed to the damp of the European climate. It may be said that the Egyptians had not any mines of tin wherewith to produce the bronze alloy. It is true that the mountainous districts of Egypt, between the Nile and the Red Sea, produced iron and copper only. Copper was also found in Arabia Petræa, which district was known to them, and even now amongst the heaps of refuse there we come upon the tubes used in the smelting apparatus.

Mines are mentioned by Agartharchidas, a Greek writer of the age of Ptolemy Philometer, and he gives a curious picture of the mode of working these mines, which were probably near the coast now called Jebeel Allaka. For additional evidence we learn from Mak rizi, an Arab writer, that this region produced silver and copper; and tradition names both Egyptian Pharaohs and Greek Ptolemies as workers of the mines. But, as we have already shown, they traded with India, and at this time, as well as from Spain, tin could be procured there.

The Phœnicians, to whom the art of navigation is so much indebted, and who carried the spirit of adventure beyond all the ancient nations, obtained tin from both India and Spain long before they visited the more distant shores of Britian, and discovered how rich were the mines of that metal there. It was worth their while to undertake a long and risky journey at sea, with possibly no other method of ascertaining their course than the stars, from the high price they were able to obtain for this commodity in Egypt and other countries where, as at Sidon, the different branches of metallurgy were carried on to great perfection. Strabo, Diodorus, Pliny, and other writers, mention certain islands discovered by the Phœnicians, which, from the quantity of tin they produced, they called Cassoterides, though the locality is not given, for Strabo says, "The secret of the discovery was carefully concealed;" and it is said that a Phœnician trader ran his vessel on a shoal and was shipwrecked, when pursued, rather than disclose his country's secret; for which he was rewarded from the public treasury. Strabo and Pliny both mention that tin was found in Gallicia and Lusitania, and further say that in consequence these countries became a rich mine of wealth to the Phœnicians.

Herodotus describes the doors of the Temple of Belus, at Babylon, as made of metal, probably bronze. The people would be more induced to attempt such work as bronze doors of their temples and public buildings in consequence of the scarcity of good timber suitable for the purpose in the land.

[*To be Continued*]

THE AMERICAN HORSE.

BY E. L. BERTHOUD, GOLDEN, COLORADO.

It is generally understood, and the fact (if it is a fact) has been almost universally accepted that the Horse was unknown in the New World previous to the advent of Spaniards in North and South America. Late discoveries and investigations extending from Behring's Straits to Patagonia, have revealed the fact (see Prof. Marsh in Encyclopædia), that in North and South America we have twelve fossil species of the genus equus, and thirty more species allied to them.

Prof. Marsh has proved conclusively the filiation of equine ancestry from the Quatenary to the Eocene, and the progressive evolution of the Horse from a many-toed ancestry. His deductions have been accepted as conclusive and

as an irrefutable proof of the evolution theory founded upon the close study of ancient fossil remains. Prof. Marsh has named a species of fossil horse found in North America, which is closely allied to the present living animal, *equus fraternus*—a brotherly horse, thus indicating its close resemblance to our useful assistant and companion.

Having had occasion to send to Paris to purchase some rare maps of the 15th and 16th centuries, I received among them the map of Sebastian Cabot, "Piloto Mayer" of Charles the Fifth, King of Spain. This map, drawn in a circular projection by Cabot himself, on which he has delineated his own and the discoveries of John Cabot, is of singular value as representing the true state of geography and discovery in the early portion of the 16th century, and was drawn up prior to the year 1546–47. Sebastian Cabot having left for England to take service there in 1547, this map was drawn by him while he was in the Spanish service previous to that date.

Now it is an incontestible fact that Cabot went in 1527 to the east coast of South America on an exploring voyage, that he discovered the rivers LaPlata and Parana, and explored them some distance inland, returning to Spain in 1530.

Upon examining that map I find that the Rio LaPlata was explored up to the 25th parallel of North Latitude, and Spanish names given to its branches and all prominent points; and in addition he has marked on the map pictures of the natives, prominent animals and some trees, and that at the head of the LaPlata with the Puma and Parrot, or perhaps the Condor, he has given the horse as apparently a quadruped that existed then in those vast plains of the *Gran Chaco*, where to-day they roam in countless herds. It may be claimed that this is not proof of their native origin, but we claim that it is a fair presumption, for neither Spaniards in Peru, nor other parts of America, or even Portugese, had been long enough in South America for the few Spanish horses introduced to have roamed wild from Peru to the head of the Paraguay and Parana Rivers and increased in numbers sufficiently to have attracted the attention of the Spanish explorers. The period was too short, and the distance too great from the Spanish possessions in Peru across the vast forests of the Andes, for such a rapid increase. We can reconcile this discrepancy only by believing that the paternity of the vast herds of the Argentine Republic, and of Paraguay, was a native breed of American horses; mixing afterward with the Spanish breed introduced by the conquerors. Not twenty years had passed between the discovery of Peru and the discovery of the Rio LaPlata.

GEOLOGY.

MIOCENE FAUNA OF OREGON.

BY CHARLES H. STERNBERG.

I propose in this short paper to give a list of the species of mammals and and turtles collected by my party on the John Day River, and on Bridge creek, of eastern Oregon, during the seasons of 1879 and 1880. I copy Prof. Cope's list published in the bulletin of the U. S. Survey, Vol. 5 No. 1, with some of his remarks on new species. These beds are equal to the White River beds of Nebraska. I have thought this paper might make my article in the January REVIEW more intelligible. For descriptions of species see Palæontological Bulletin, No. 30, *American Naturalist*, December, 1878, and Bulletin above quoted where they are described in detail, by the able paleontologist, Prof. E. D. Cope, of Philadelphia. All these specimens are in his possession.

WHITE RIVER FAUNA.*

TESTUDINATA.—Stylemys Oregonensis, Leidy.
RODENTIA.—Steneofiber gradatus, Cope.
Steneofiber Nebrascensis, Leidy.
Meniscomys hippodus, Cope.
M. multiplicatus, Cope.
Eutoptychus cavifrons, Cope.
E. planifrons, Cope.
E. crassiramis, Cope.
Pleurolicus sulcifrons, Cope.
Palæolagus Haydeni, Leidy.
CARNIVORA.—Hoplophoneus brachyops, Cope.
Machærodus strigidens, Cope.
Enhydrocyon stenocephalus, Cope.

In this new genus and species we observe a nearly complete cranium belonging to the typical species, the shortness of the facial part of the skull as compared with the length of the cerebral, and also the constriction of the skull back of the orbits. The zygomatic arches are robust and expanded, and the sagital crest is high. The auditory bullæ are inflated and thin-walled. The length of the skull is about that of the coyote, but it is more robust in all its proportions except the postorbital constriction.

Discovered by Charles H. Sternberg in the Oregon White River beds of the John Day River region.

* Prof. E. D. Cope, Bulletin U. S. Survey, No. 10.

Enhydrocyon basilatus, Cope; sp. nov.

"This species was probably of the dimensions of the grey wolf."

Temnocyon altigenis, Cope.
Canis Hartshornianus, Cope.
Canis Geismarianus, Cope.
Canis Curpigerus, Cope.
Canis Lippincottianus, Cope.
Canis Gregarius, Cope.

PERISSODACTYLA.—Dæodon Shoshonensis, Cope.
Aceratherium pacificum, Leidy.
Anchitherium equiceps, Cope.
A. brachylophum, Cope.
A. longicriste, Cope.

ARTIODACTYLA.—Elotherium imperator, Leidy.
Palæochocrus Condoni, Marsh.
P. pristinus, Leidy.
P. socialis, Marsh.
Merycopater Guyotianus, Cope.
Eucrotaphus superbus, Leidy.
E. occidentalis, Marsh.
Merycochocrus Leidyi, Bettany.
M. temporalis, Bettany.
Poëbrotherium Sternbergii, Cope, sp. nov.

"This ruminant is represented by a considerable part of the skeleton, with both mandibular rami supporting the teeth of one individual. The third and fourth metacarpals are not coössified and the second and fifth are not distinguishable." This is likely an ancestor of the Llama or Camel.

Boöchocrus humerosus: genus and species new.

"The species on which this genus is founded is represented by a part of the skeleton which is unfortunately not accompanied by cranial bones or teeth. The great tuberosity of the humerus is produced beyond the head, and does not close around the bicipital groove." It was about the size of the Indian Rhinoceros; discovered by C. H. Sternberg.

Leptomeryx Evansi, Leidy.
Hypertragulus calcaratus, Cope.

Prof. Cope places these last two genera in the new family he calls the *Hypertragulidæ*. It connects the *Tragulidæ* with the more typical *Ruminantia*.

DIATOMS.

HENRY G. HANKS, STATE MINERALOGIST, CALIFORNIA.

A diatom is generally admitted to be a single celled plant, bearing a singular relation to the animal and even to the mineral kingdom, being considered by some to belong partly to the latter, and regarded as a vegetable crystal, differing only from minerals in having the power of locomotion, and of multiplying by separation. Kutzing says: "In comparing the arguments which indicate the vegetable nature of the diatomaceæ with those which favour their animal nature, we are, of necessity, led to the latter opinion."

In connection with the idea that the diatoms pertain somewhat to the mineral as well as the animal kingdom, it is a curious fact that silica deposited from fluoride of silicon, if crushed between plates of glass and examined microscopically, with a medium power, markings may be seen on the outer surfaces of the vesicles which resemble those of the diatoms, especially pleurosigma and coscinodiscus. It is also remarkable that Dr. James Blake collected fifty species of living diatoms from a hot spring in Pueblo Valley, Nevada, the temperature of which was 163° Fahr. Flint probably originates from diatoms, as does also the silica in certain rocks.

The name diatom is derived from a Greek word signifying being cut in two. Diatoms resemble the desmids, but differ in having an outer skeleton, or frustule, of silica. The frustule of a diatom is a silicious box, always in two parts, one slipping over the other like a pill box or with edges apposed. The thickness of a single diatom is, roughly, the sixth that of a human hair, and its weight is estimated at the 187-1,000,000th part of a grain. Some varieties attach themselves to other bodies, as the algæ, while others swim in the water free. The study of the diatomaceæ, aside from their scientific interest, is very fascinating. Their extreme and varied beauty is a source of constant pleasure to the microscopist, and the question is often asked, Why is so much beauty veiled from human sight?

The beauty of the diatoms consists in their color, their general form, and sculpture, or natural marking, which characterize nearly all of them. These delicate markings are seen under the microscope to be processes, knobs, bosses, concavities, ribs, groovings, and lines, so minute that the highest powers made by the most skillful opticians are required to see them at all; even then they can only be seen when the apparatus is manipulated by the most skillful operators. The lines of certain diatoms have been measured, and are used to test the magnifying and penetrating powers of object glasses. A slide called a test plate has been prepared on which twenty well known species are mounted, commencing with one on which the lines are comparatively coarse, and ending with one—*Amphipleura pellucida*—which has 130,000 lines to the linear inch. For the convenience of study typical diatoms are mounted on a single glass slide, so arranged that reference can be made to a printed catalogue for the names, while in some cases the names of the species are microphotographed on the slide.

The diatoms are placed on the plate by the aid of an ingenious device called a mechanical finger, by means of which the shells can be picked up singly and given the desired position. *Moller's Typenplatte No. 1* has twenty-four lines in each of four groups, comprising about 500 individuals of 395 distinct species and 17 genera. The cost, with printed catalogue, is forty dollars.

Some microscopists are so fond of the study of these minute forms that they scarcely do any other work than to observe, collect, classify, and describe them.

When it is stated that the names of more than 4,000 distinct species of diatoms are given in a catalogue published by Frederic Habirshaw, of New York, each of which has some feature by which it may be distinguished, that this vast kingdom, so to speak, is invisible to the human eye, or nearly so, that when highly magnified many of the species are extremely beautiful, and all of them interesting, it is easy to understand why so much interest is taken in them the wide world over, and why every new discovery is heralded, and calls for samples come from the whole scientific world.

It is an established fact, strange as it may seem, that some of the greatest mountain chains, such as the Andes, and the very soil beneath our feet are chiefly composed of the remains of animalcules, invisible to the eye; that is to say, the matter has been used by animated beings, and returned again to the mineral kingdom, retaining the form which it assumed while a part of their minute bodies. Byron has written with more truth than he probably realized that "The dust we tread upon was once alive," and the remark of Dr. Buckland is often quoted: "The remains of these minute animals have added more to the mass of minerals which compose the exterior crust of the globe than the bones of the elephants, hippopotami, and whales."

In the tertiary age, beds of diatomaceous or infusorial earth were deposited, consisting almost wholly of these microscopic organisms. The extent of some of these deposits is almost incredible, and is regarded as an evidence of the great age of the world. The Bohemian deposit in Europe is fourteen feet thick, and, by the estimation of Ehrenberg, contains 40,000,000,000 diatoms to the cubic inch.

Darwin observed in Patagonia, along the coast for hundreds of miles in extent, a bed of tertiary sedimentary formation, 800 feet in thickness, overlaid by a stratum of diatomaceous earth. At Bilin, in Austria, a bed of infusorial earth, fourteen feet thick, occurs. One merchant sells annually many hundred tons of it. The *Bergmehl*, or mountain meal, of Lapland and Norway, is from beds thirty feet in thickness. It must be remembered that these deposits extend over many thousands of square miles. Notwithstanding the astonishing fact that vast areas of the earth's surface are built of these minute forms, the true nature of these deposits was not known until 1837, when Ehrenberg published his celebrated work on that subject. The same deposition is taking place at the present time. In certain lakes in the United States and elsewhere, deposits several inches in thickness accumulate, composed wholly of the remains of recent diatoms. When thoroughly dried a chalky powder is obtained, which, under the micro-

scope, is easily recognized. Similar deposits have been made known by dredging the bottom of the sea. According to Professor Joseph Le Conte, in the deeper parts of Lake Tahoe, which sediments do not reach, the ooze is composed wholly of diatoms or infusorial shells.

Dusty showers of a grayish or red colour are not unfrequent on the Atlantic and Indian Oceans near the coast of Africa. Ehrenberg examined this dust and found it to consist largely of diatoms. He estimated the quantity let fall during a dust shower in the year 1846, near Lyons, at 720,000 pounds, one-eighth of which was diatomaceous, or 90,000 pounds, equal to forty-five tons. Diatomaceous earth may be distinguished from other formations of a similar appearance by its insolubility in acids, extreme lightness, power of absorbing liquids, and property of polishing metals. It is instantly recognized under the microscope in the hands of one who is familiar with its use. Diasomaceous earth has its uses as well as its scientific interest. It is largely consumed as a polishing powder under the name of tripoli, from the locality which first gave it to commerce. It is known in California by the absurd name of electro-silicon, and at the East by a variety of trade names. It is a very convenient source of soluble silica, employed in the manufacture of silicate of soda or potash, also known as soluble glass. The manufacture of this compound is simplicity itself. Carbonate of soda or potash, as the case may be, is dissolved in boiling water to saturation, in a capacious iron kettle, and fresh hydrate of lime added until all the carbonic acid is precipitated and the alkali becomes caustic. Diatomaceous earth in a powdered state is then added as long as silica is dissolved, and the whole covered and allowed to cool. When the insoluble matters have settled the clear liquid is drawn off and evaporated in a clean vessel to the required density.

Diatomaceous earth is also used in the manufacture of porcelian, and it is a constituent of certain cements and of artificial stones. At one time it was claimed to be a fertilizer, but this is thought to be a fallacy, although Ehrenberg states that the fertilizing power of the Nile mud is furnished by fossil infusoria.

Slabs of diatomaceous earth absorb liquids with avidity, and are used in laboratories for drying crystals and filters. This property might be more generally utilized if better known. A convenient contrivance for lighting fires is a lump of diatomaceous earth with a handle of stout iron wire. It is dipped into a vessel of petroleum, placed in the stove or fire place, and lighted with a match. It continues to burn safely for some time.

Bricks that float in water are made of diatomaceous earth mixed with one twentieth part of clay and well burned. The art of making these floating bricks was well known in the time of Pliny, but was afterward lost. It has recently been discovered. In the Italian department of the Paris Exhibition of 1878, these bricks were exhibited, which attracted considerable attention. Floating bricks, made wholly of California material, may be seen in the State Museum.

Kieselghur, or "flint froth," of the Germans, from a deposit in Hanover is extensively used in the manufacture of dynamite, giant powder, lithofracteur and other explosives. Diatomaceous earth absorbs from three to four times its

weight of nitro-glycerine, with the advantage over other absorbents of retaining the nitro-glycerine under greater pressure. Dynamite contains 27 per cent. and lithofracteur 23 per cent. of diatomaceous earth.

Before the kieselghur can be used it is subjected to treatment to remove water, all organic matter, and coarse particles. It is first calcined in a succession of furnaces, crushed between rollers and sifted.

It is claimed that the diatomaceous earths of California are unfit for this purpose, but it is the opinion of the writer that they have not had a fair trial.

Diatomaceous earth is largely used in the manufacture of soap to mechanically increase its detersive power. The Standard Company receive large quantities of it from the southern counties of the State.—*Mining and Scientific Press.*

GEOGRAPHY.

THE VOYAGE OF THE PROTEUS TO LADY FRANKLIN BAY.

LADY FRANKLIN BAY,
ON BOARD THE PROTEUS, AUG. 17TH.

After vexatious delays the Proteus, with its load of hopeful explorers, has reached this point, where it was the purpose of the party, on setting out, to build a house for the winter. The last two weeks have been very eventful, and fortune has wonderfully favored us.

Our progress seemed to be hopelessly cut off on the 6th by the great Northern ice pack, against whose southern face we lay, wholly unable to advance. Up to that point we had been remarkably favored. Only three other ships had ever reached the place where we then were, off Cape Baird, at the southwestern end of the bay. They were the Polaris, Capt. Hall commanding, and the Alert and the Discovery of the English expedition, under Capt. Nares. Unlike us, all three encountered troubles from Melville Bay all the way up. They had to fight ice continually. The Polaris fared better than either of the others, but she had to fall back finally. Until we reached Cape Baird, 81° 35′ north latitude, we met with no obstacles in the way of ice. We met and passed monstrous icebergs, and passed around and through fields of ice floes, pan ice, etc., but of such a nature that it offered little resistance. The icebergs of course, when scattered are of no particular danger, because we can usually keep out of their way. The only time to fear them is in a fog or storm. But in these respects we were favored when icebergs were numerous. To make a long story short, we came through from Disco to that point in the very quickest time that has ever been made, or that we expected to make. We met so little ice—the waters in Smith's Sound and Kennedy's Channel were, in fact, so free of ice—that we were lost in wonder.

We had really begun to speculate about running our little steam launch right through from Lady Franklin Bay to the North Pole.

Very soon, however, we ceased to think of such an exploit, by reason of the stern reality with which we were brought face to face. We were suddenly confronted with an impassable ice pack. Since we were within only eight miles of this place, on the north shore of the bay, which was our destination, our disappointment can be imagined. It was of course, useless to lament. We had to make the best of it. The pack extended across Robeson channel from shore to shore, and, we thought likely, all the way to the North Pole. It would have been as useless to try to move the world as to force our way through it. At the ship's side the ice was from eighteen to twenty feet thick. Looking across it, it showed one series of hummocks. I traveled about three miles to the north on the pack, and found it not very easy work. All we could do was to wait and take our chances. We lay in one place two days before the 9th, in which time about half a mile of ice broke away, after which we possibly worked ahead, by starting another point, a mile or so. Then the thickness of the pack increased, and it became more and more rough, hard and hummocky. We were, however, in constant hope that enough would break away to enable us to make our camping place and unload the ship before the whole pack moved, though there was grave danger that the pack would start all at once. In that event we expected to have to run before it, and there was no telling then how far south it would drive us. Of course we did not anticipate with pleasure the possibility of being carried back after getting within sight of, and only eight miles distant from, our objective point. We feared that if driven out by the pack we could not get back this season, because it was to be expected that in two or three weeks' time new ice would form of such thickness that the ship could never cut through it, and the pack ice was not likely to run out in that time. Even at that early day new ice formed every night. I cannot describe how tantalizing the impenetrable barrier was to us, and how powerless we were to do anything.

We hoped for the best, however, and, as it turned out, not in vain. We gradually had to retreat before the pack, dodging floes here and there as we went, until we were fully forty miles south of the place where we first encountered it. Then a southwest gale sprang up, which at last drove the ice toward the eastern shore, and left a free passage for us to run in here. Our house is under way, and everything is unloaded from the vessel except the coal—140 tons. When this is done, which will be soon, the ship will leave us, and we must say our parting words for one long year. The ship cannot stay a moment after she is unloaded, as she would, by so doing, run the risk of being caught in the ice for the winter. This letter will probably reach you sooner than those which I sent you from Disco and Upernavik, since they have to go to Denmark by sailing vessel.

And now about the trip before we reached Lady Franklin Bay. We had some stormy weather on the voyage, and there were only four of us who were not seasick—Lieut. Lockwood, three sergeants and myself. The long day seemed a little strange to me at first, but now I am fully accustomed to it. The sun

with us is now as light at midnight as at noon, and it will so remain until about the middle of October, when the long night will fairly begin. This is the only thing I actually dread. Think of 140 days without the sun! But others have gone through the Arctic night and I think we can. But just think for a moment how blessed, how glorious the sun will appear to us when it first again makes its appearance next March!

We were very successful in our hunting, and in this we are ahead of the other expeditions. At Upernavik and Rittenbeck (we stopped at the latter place a day and a half), and at other places on the bay, we killed altogether and brought to the ship nearly 800 birds, ducks, auks (a sort of a duck) and a few geese. The Polaris and the British expedition did not get so many birds during all the time they were here. My party, consisting of four of us, in one day's shooting brought home 304 birds. This was the best day's sport. The most noted place for bird-shooting is what is called "Sanderson's Hope," near Upernavik. We went there in our whale-boat. It is an island of lofty mountains, and the birds congregate there in countless numbers and build their nests in the cliffs. The cliffs are vertical and of great height. The air is filled with birds, and the noise made by their wings was like a violent hurricane of wind, when, in fact, all was calm around us—the sea without a ripple.

We also killed a polar bear. Most unexpectedly to us all, in crossing Melville Bay we came across a bear on an ice floe. Of course all was excitement in a moment. We were at supper, but hastily jumped up, and I found myself in a boat, together with Lieutenant Lockwood and Mr. Clay, a gentleman who is with the expedition, being rowed toward Bruin, and I did not realize that it was quite chilly, and that I was only provided with slippers and without a coat and gloves, until after the bear was dead. Several shots were fired at him from the ship, and he was hit twice, once by myself, in the side, but neither shot stopped his movements. Finally, from the boat I had the honor of sending a ball squarely through his brain. We towed him after us and got him aboard the ship, and our photographer took a picture of him. Before I left home the Remington Rifle Company sent me from New York their last improved rifle, and no doubt will be pleased to learn that it killed the first white bear of our expedition. He was coming directly toward the boat when I shot him, and looked very savage. He was a powerful brute, and would have made short work of any man if he had got near enough.

We stopped here and there on our way up to examine provisions which have been left by different expeditions, and which we can use should it become necessary. We stopped at Littleton Island, and from there I was sent with a party to visit Lifeboat Cave, and the place where the ship Polaris sank. Part of the Polaris' crew wintered there. This was quite historic ground. The wood pertaining to the house had been taken away, not a vestige remaining, probably by the Esquimaux. There were all sorts of odds and ends, an old stove, stovepipe, iron, copper, lead, pieces of the engine, pulleys, etc., strewn around the

place. Our photographer was with us, and I had him make a picture of every thing as we found it. This trip I enjoyed very much.

Coming back we were close to several walruses sporting in the water, and finally succeeded in shooting two of them. One of them was coming toward our boat with his mouth open, and very determined and savage-looking. Mr. Clay and myself let him come within twenty feet of us, when we lodged two balls in his head. Mine went into his mouth. He sank at once and this was the last seen of him. This is the objection to shooting walruses in the water.

They sink as soon as dead, and unless they are harpooned there is no way of getting at them. We had no harpoon. The only certain way to get them by shooting would be to catch them on the land or ice, creep up to leeward of them and shoot them in the head. But this can rarely be done, unless the ball strikes the eye, because their heads are solid masses of bones. Mr. Clay killed the other walrus, a young one. I felt sorry for killing the poor things when we found we could not secure them, and shall not shoot any more unless we can be certain of gathering them afterward.

Another party visited Littleton Island, and secured the mail left by the ship Pandora for the English (Capt. Nares') expedition. This will be sent to England by our returning ship. We also visited Cary Island and Ritter Bay, and left some supplies at the latter place. We also visited Cape Hawkes, and examined some supplies left by the English expedition, and took aboard a fine boat left by them for the convenience of polar expeditions.

We have seen many strange animals of the deep. Schools of white whales and numbers of norwhals have made their appearance frequently. Several seals have been seen, but they are very shy. Lieutenant Lockwood and myself killed a monster square-flipper seal, the largest kind, about 300 miles south of here. We spied him from the ship on a cake of ice, and we rowed out to him very quietly. I sent one bullet through his neck and Lockwood one into his body. He rolled off into the water, but we were close to him, and quickly drove a gaff into him and hauled him back upon the cake and then into the boat. He weighed 400 pounds.

Musk oxen and seals are our main dependence for fresh meat, and, with the exception of bears and foxes, not very plentiful, are almost the only living things found so far north. Occasionally a bear or wolf makes its appearance. We have seen a few geese from the ship, and have killed five dovekies, sometimes called sea pigeons, but the auks and ducks have all apparently remained south. We have killed to-day fourteen musk oxen, which will give us fresh meat for three months for everybody.

We have two Esquimaux with us, and they afford a good deal of amusement to everybody. We depend upon them to teach us many things, particularly dog driving. They appear to be jolly, willing, good-natured fellows, and come highly recommended. I had one on the ice and he gave us considerable sport, especially when it came to jumping across the cracks in the ice. His legs were so short that he frequently fell short of the other side, when, of course, there would be a

scramble. Sometimes the poor fellow would not attempt some of our long jumps, and would have to walk a long distance to find a narrower crack. Usually they have along their kyacks to cross such places with, but this time he failed to bring one. The kyack is a singular-looking skin boat. It is sometimes spelled kayack.—*Cor. Globe-Democrat.*

THE HUDSON'S BAY ROUTE.

The Canadians are building their Canada Pacific R. R., running through the dominion from east to west, and in addition to this they have incorporated the Nelson Valley Railway and Transportation Company, whose purpose is to build a road from Churchill harbor, at the western side of Hudson's Bay, southwardly to Lake Winnepeg, on the line of the Canada Pacific, from where still another road is to be built to tap our Northern Pacific at a point near Bismarck. The object of this scheme is apparent. The distance from Churchill harbor to Liverpool is 114 miles nearer than that from New York to Liverpool, while the distance from Winnepeg to Churchill harbor is 1,300 miles shorter than that from Winnepeg to Montreal by way of Chicago. The great grain fields of the northwest, along the line of our Northern Pacific road, and above that in British America, are the objective point of this system of improvements. This vast region is being rapidly settled and is destined to yield a large proportion of the wheat that must go from America to Europe. The trade is worth striving for, and if the Canadians, with the encouragement and help of British capital, can secure it, the advantage will be a great gain to them and a great loss to our northern lines which are looking forward to it as a heritage they are entitled to. Heretofore, Hudson's Bay has been regarded as in the Arctic region, and too far north to be capable of figuring in the trade movement. But the time was when the region along our Northern Pacific was regarded in the same light, and yet this region is now becoming the great grain district of our country. It is not impossible, therefore, that the harbor at the lower point of the Hudson's Bay, may in the near future become an important shipping point from which the whole trade of the Winnepeg and Saskatchewan will take water for Europe.

THE LOST JEANNETTE.

Intelligence from the Rodgers, sent out by the Government to search for the Jeannette in the Arctic regions, has been received. The despatch is dated St. Lawrence Bay, Aug. 18th, and is in substance, that the whaler R. B. Handy reports the Esquimaux at Point Barrow as saying that they saw four white men going toward Mackenzie River this spring, and found where they had made snow huts to live in during the winter. They saw dead men in the huts, and also saw tracks of a sledge, with dogs and footprints of men, supposed to be survivors of the Jeannette. The Rodgers and Strelock will investigate the rumors, and expect to send more authentic news before the close of the summer.

A letter has been received from Henry M. Stanley, the African explorer, dated Congo River, July 4, in which he states that he was seriously ill all through the month of May, so seriously that on the fifteenth day of his illness he gave, as he thought, his last orders to his European companions; but the crisis passed and he is now strong and hearty.

ASTRONOMY.

TRANSIT OF MERCURY AND NOTES FOR NOVEMBER, 1881.

BY W. W. ALEXANDER, KANSAS CITY, MO.

On the evening of the 7th at 59 minutes before sunset, the planet Mercury will begin its transit. The Kansas City Mean Time of the visible phases are:

Exterior Contact Ingress, 3h 57m 34s P. M.

Interior Contact Ingress, 3h 59m 17s P. M.

Apparent diameter of Mercury 9.9″, of the Sun 1910.6″.

The place where it will first appear on the Sun will be a little south of east, or 129° from the north point toward the east. The transit will not be visible to the naked eye, and need only be looked for with a telescope magnifying at least fifteen or twenty times.

THE SUN.

Date.	Right Ascension.		Declination S.		M. T. of Meridian Passage.		
1st.	14h.	28m.	14°	38′	11h.	43m.	43s. A. M.
5th.	14	44	15	53	11	43	45
10th.	15	04	17	20	11	44	07
15th.	15	24	18	40	11	44	51
20th.	15	45	19	51	11	45	56
25th.	16	06	20	53	11	47	21
30th.	16	27	21	45	11	49	04

Semi-diameter on he 1st 16′ 10″, on the 30th 16′ 15″. Sidereal time of mean noon on the 1st, 14h. 44m. 41.04s., on the 15th, 15h. 39m. 52s., on the 30th 16h. 39m. 00s.

THE MOON.

Date.	Right Ascension.		Declination.			Semi-diameter.	
1st.	23h.	03m.	0°	27′	S.	16′	10″
5th.	2	38	17	52	N.	15	48
10th.	7	09	19	16		14	59
15th.	11	01	00	38		14	54
20th.	15	09	19	27	S.	15	49
25th.	20	08	15	56		16	15
30th.	0	34	8	35	N.	15	55

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage.
1st.	15h. 20m.	22° 26′	0h. 35m. P. M.
5th.	15 04	18 15	0 04
10th.	14 41	14 47	11 13 A. M.
15th.	14 27	12 28	10 43
20th.	14 31	12 20	10 30
25th.	14 48	13 46	10 29
30th.	15 11	15 54	10 34

VENUS.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage.
1st.	12h. 49m.	3° 33′	10h. 05m. A. M.
5th.	13 08	5 27	10 08
10th.	13 31	7 48	10 12
15th.	13 54	10 05	10 15
20th.	14 18	12 16	10 20
25th.	14 42	14 20	10 24
30th.	15 07	16 15	10 29

Apparent diameter on the 1st, 11.6″, on the 30th, 10.8″. Sidereal time of the semi-diameter passing the meridian, 0.38s.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	7h. 00m.	23° 52′	4h. 14m. A. M.
5th.	7 04	23 57	4 01
10th.	7 06	24 06	3 44
15th.	7 08	24 18	3 26
20th.	7 08	24 32	3 06
25th.	7 06	24 50	2 44
30th.	7 03	25 19	2 21

It will rise on the 30th at 6h. 51m. P. M., and is in a very favorable position for observation in the evening.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	3h. 22m.	17° 16′	0h. 35m. A. M.
5th.	3 20	17 08	0 17
10th.	3 17	16 58	11 55 P. M.
15th.	3 14	16 48	11 33
20th.	3 12	16 38	11 10
25th.	3 09	16 28	10 48
30th.	3 07	16 19	10 26

Apparent diameter on the 1st, 46.7″, on the 30th, 46.4″.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 29m.	11° 57′	11h. 43m. P. M.
5th.	2 28	11 50	11 26
10th.	2 26	11 43	11 04
15th.	2 25	11 36	10 43
20th.	2 23	11 30	10 22
25th.	2 22	11 24	10 01
30th.	2 21	11 18	9 40

The apparent elements of its ring; outer Major Axis 45.3″, Minor Axis 14.4″. Inclination of northern semi-minor axis to circle of declination from north to east, 0° 01.1′. Elevation of the earth above the plane of the ring, 18° 37.5′, of the sun, 19° 26.7′. Earth's longitude from Saturn counted on plane of ring from the ring's ascending node on Equator, 89° 51′, on Ecliptic, 47° 07′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	11h. 14m.	5° 41′	8h. 26m. A. M.
15th.	11 16	5 28	7 33
30th.	11 18	5 19	6 36

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 54m.	14° 41′	00h. 07m. A. M.
15th.	2 52	14 34	11 10 P. M.
30th.	2 50	14 28	10 10

PHENOMENA.

On the 5th at 1h. 32m. P. M., conjunction of Saturn and the Moon. Saturn south 5° 29′.

On the 6th at 0h. 16m. A. M., conjunction of Neptune and the Moon. Neptune south 4° 02′.

On the 6th at 11h. 46m. A. M., conjunction of Jupiter and the Moon. Jupiter south 2° 48′.

On the 7th at 4h. 00m. A. M., opposition, Neptune and the Sun.

On the 7th at 6h. 50m. P. M., conjunction of Mercury and the Sun, interior and transit.

On the 10th at 4h. 23m. P. M., conjuction of Mars and the Moon. Mars north 4° 44′.

On the 13th at 1h. 50m. A. M.. opposition of Jupiter and the Sun.

On the 16th at 2h. 07m. A. M., conjunction of Uranus and the Moon. Uranus north 6° 26′.

On the 17th at 1h. 00m. A. M.. Mercury stationary in right ascension.

On the 17th at 6h. 00m. A. M., Mars stationary in right ascension.

On the 19th at 6h. 20m. P. M., conjunction of Venus and the Moon. Venus north 4° 33′.

On the 20th at 1h. 13m. A. M., conjunction of Mercury and the Moon. Mercury north 5° 12′.

On the 24th, Mercury's greatest elongation, west 20° 00′.

REMARKABLE AURORAS.

BY PROF. S. A. MAXWELL, MORRISON, ILL.

A writer in the Albany, N. Y., *Argus*, gives an interesting account of the wonderful, luminous phenomenon, seen throughout a large portion of the north Atlantic States, on the evening of September 12th. The phenomenon here referred to, was a band of white light, about 12° in width, spanning the heavens from east to west.

It is evident that the writer is anxious to learn the real nature of this singular appearance; for notwithstanding the fact that a dozen or more theories were at once advanced to explain it, he still asks, "what was it?" An assistant at the Dudley Observatory, when interviewed, said that he did not dare to make any assertion in the matter, and concluded by saying, "It may have been an aurora, but so far as my knowledge goes, it was something unique."

It is probable that a similar phenomenon has not been heretofore witnessed by the people of Albany; at any rate, not at a time within the memory of the present generation. Nevertheless there are people, even in that city, who claim to have observed such sights previous to the war.

Although the telephone wires were unaffected at the time of its occurrence, I believe that the phenomenon was one of the many forms of the aurora. My chief reason for this belief is, that on the night of Friday, October 14th, 1870, a similar phenomenon took place, while at the same time a genuine aurora lighted up the northern heavens, both with luminous arch and bands. This aurora somewhat suggested a vast wheel, the lower arch near the horizon forming the hub, the polar bnnds or streamers, representing the spokes, and the zenith arch, (like that seen at Albany,) the outer rim of the wheel.

At another time, the evening of Friday, April 2nd, 1869, I saw a similar luminous band, which extended across the heavens, almost from east to west, inclining toward the northwest and southeast. Neither this one, nor the one above noted, was over two or three degrees in width, but the light in both cases was of a pure white and tolerably well defined at the edges. In the phenomenon of April 2nd neither extremity extended quite down to the horizon; and about ten degrees from the western end, there was a bend that extremity lying more nearly horizontal than the other.

While one of these auroras, the one of October 14th, illumined the heavens, the lower arch was partially obscured by clouds, over whose corrugated surfaces,

frequent flashes of lightning played, thus furnishing another element of sublimity to the scene.

In speaking of remarkable auroras, I cannot omit mentioning the one of September 24th, 1870. Many who read this will doubtless remember the event, though the precise date of its occurrence may have escaped their recollection. The characteristics of this most wonderful of auroras, were the large area over which it was visible, the extent of the visible heavens over which it spread; the variety and brilliancy of its colors, and the trembling waves of lambent light which ascended spirally toward a vortex a few degrees southwest of the zenith. The scene presented surpassed the power of description. I remember how the little patches of red light would vanish and reappear, almost before one had time to think; while others, if they disappeared, would not return again, or if they did, would be somewhat modified in color, in form, or in position. This aurora remained brilliant until about eleven o'clock, at which time it began to disappear, first along its southern border, which was but a few degrees above the horizon; after a short time it receded past the zenith, and at midnight there was nothing unusual in its appearance—being a simple arch of white light near the northern horizon, with perhaps a few inconspicuous streamers of the same color.

I do not know whether others have observed that the highest point of the arch of an aurora does not appear due north, but varies with magnetic declination. In this locality the aurora is brighest somewhat to the east of north. I find also that the vortex or corona of the last mentioned aurora was just about as many degrees to the south of the zenith, as the north magnetic pole of the earth is distant from the axial pole.

The mysterious band of light seen at Albany was probably, what I have stated, a mere auroral arch, but, appearing as it did, in the zenith, more nearly resembled a band than an arch. The same, viewed from a lower latitude would have presented an arch-like appearance, similar to those often seen by us in the distant north; and these latter would present to an observer beneath them, the same band-like appearance seen at Albany.

The observatory in the neighborhood of Nice, which is being erected at the expense of M. Bischoffsheim, is rapidly approaching completion. The great equatorial telescope is to be one of the largest in the world—perhaps the largest—as it will have an object-glass three feet in diameter and a focal length of upward of fifty feet. The construction of this monster telescope has been intrusted to MM. Paul and Prosper Henry, of Paris, and the total cost of the observatory will be more than $400,000 in American money.

METEOROLOGY.

REPORT FOR THE MONTH ENDING OCT. 20TH, FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

Highest barometer during the month 29.36 in. on the 9th. Lowest barometer during the month 28.55 in. on the 29th.

Highest temperature during the month 95° on the 27th. Lowest temperature during the month 25° on the 5th.

Highest velocity of wind during the month 45 miles on the 24th. Number of miles traveled by wicd during the month 12,500.

Lunar halo on the 6th at 9 P. M.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Sept. 20th to 30th.	Oct. 1st to 10th.	Oct. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	53.0	50.7	42 2	48.6
Max	86.9	78 2	64.3	76.5
Min. and Max	70.2	64 3	52.6	63.0
Range	34.1	27.5	21.0	30.9
TRI-DAILY OBSERVATIONS.				
7 a. m.	67.7	63.3	47.0	59.3
2 p. m.	81.7	75.7	51.2	69.9
9 p. m.	70.8	65.2	52.9	63.0
Mean	72.9	69 0	52.1	64.7
RELATIVE HUMIDITY.				
7. a. m.	.71	.89	.92	.84
2 p. m.	.50	.64	.78	.64
9 p. m.	.61	.82	.88	.77
Mean	.61	.78	.85	.75
PRESSURE AS OBSERVED.				
7 a. m.	28.81	29.15	29 09	29.02
2 p. m.	28.79	29.10	29.04	28.98
9 p m.	28.80	29.11	29.05	28.99
Mean	28 80	29.12	29.06	28.99
MILES PER HOUR OF WIND.				
7 a. m.	18.3	11.2	14 7	14.7
2 p. m.	25.4	21.1	15.6	20.7
9 p. m.	15.2	16.0	16.7	16.0
Total miles.	5104	3703	3693	12500
CLOUDING BY TENTHS.				
7 a. m.	4.8	8.1	9.6	7.5
2 p. m.	5.9	7.5	7.4	6.9
9 p m.	6.6	6.3	6.2	6.4
RAIN.				
Inches	.72	.48	3.71	4.91

ON THE CAUSE OF THE ARID CLIMATE OF THE WESTERN PORTION OF THE UNITED STATES.

BY CAPT. C. E. DUTTON, U. S. A., U. S. GEOLOGICAL SURVEY.

Read before Section B, American Association for the Advancement of Science, Cincinnati Meeting, August 18th, 1881.

Many questions arising in the study of western geology involve the consideration of the arid climate of the region, and I have frequently been led to inquire as to its cause. Arid climates are usually attributed to the passage of prevailing winds over high mountain chains. As they ascend the mountains upon the windward sides they are cooled by the expansion due to diminished barometric pressure, their capacity for moisture is reduced and an abundant precipitation takes place. Descending upon the leeward sides these changes are reversed; the air is heated, its capacity for moisture is increased it becomes dry, and having been depleted of moisture is supposed to be incapable of yielding a copious supply to regions beyond. This explanation is no doubt good for some localities. Peru is a case in point and for that country it seems quite perfect. It is believed by many that it also explains the arid climate of the western half of the United States, and that the Sierra Nevada is the range which robs the winds of that region of the moisture which otherwise would make its vast expanse fertile. Reflection upon this case has led me to a different conclusion.

It is unquestionable that the Sierra Nevada abstracts a notable amount of moisture from the winds blowing from the Pacific. Mr. B. B. Redding, the Land Agent of the Central Pacific Railroad, has kept for several years excellent records of the rainfall at many stations in California and Nevada, and informs me that along the main road from Sacramento to the summit pass of the Sierra, the annual rainfall increases at the rate of one inch for every one hundred feet of altitude. At the summit the mean annual precipitation exceeds ninety inches. It is not improbable that this large amount is considerably exceeded at numerous points along the crest of the range. It seems clear therefore that the winds which blow over the Sierra are to some notable extent depleted of moisture and the effect must be to at least aggravate the aridity of the regions lying immediately east of the range. But I think it can be made evident that this effect is relatively not great, and that the elevated region of the west would be on the whole very nearly as arid as it now is if the Sierra Nevada were obliterated as a mountain range. Nor can the other and lower ranges lying east of the Sierra affect the case materially, for surely more than ninety per cent of the rain and snow which fall upon them are reëvaporated *in loco* and the atmosphere ultimately suffers no material loss of moisture.

When the winds blow constantly from a cool to a warmer region they become warm and therefore dry; and if they have no opportunity to take up more

moisture on the way the passage from a cool to a warm region is a sufficient cause of aridity. This is, I conceive, the state of affairs which determines the climate of the western mountain region. The winds blow constantly from the western quarters, being the "return-trades." Local winds and perhaps large cyclones occasionally turn the weathercock toward an easterly quarter, but the general drift of the great atmospheric ocean is ever from west to east.* This prevailing air drift comes from the Pacific and reaches the coast nearly or quite saturated with moisture. The quantity of moisture required for saturation is dependent chiefly upon temperature; and the temperature of the air as it reaches the coast is determined by oceanic conditions.

From the Aleutian Islands a coastwise ocean-current moves southward, having a breadth of 500 miles or more, and extending as far southward as the latitude of Cape St. Lucas. Off British Columbia and Alaska it may be regarded as a warm current relatively to the adjoining land. Off the Californias although its temperature rises notably with its southward movement it may be regarded as a relatively cool current. On the more northerly shores its effect is to make the climate of the adjacent coast warmer than it would otherwise be; and its effect on the more southerly shores is to make them cooler. Stated in another manner, the relation is such that the temperatures of the land areas in the high latitudes are lower than those of the ocean, while in the low latitudes they are higher. In the high latitudes, therefore, the winds blowing from the Pacific are cooled by the land; in the low latitudes they are warmed by it. Hence the precipitation is copious in the former regions and meager in the latter. Between the two belts where these opposite effects are pronounced is a region where they shade into each other, and though this intermediate region cannot be marked out by distinct boundaries it may still be said to exist in latitudes lying within the valley of the Columbia River.

The cause of an arid climate thus indicated may be regarded as generally operative throughout the western mountain region; and it will no doubt appear upon full consideration to be much more potent and widely extended in its action than any or even all of the mountain ranges could be. It is, however, greatly modified by the intervention of local causes, which occasionally mask or obscure it. The precipitation in different portions of the region is highly irregular and several modifying causes can be indicated which, though they do not nullify the more general one here set forth, frequently become much more conspicuous in their effects. For instance, it is well known that the heaviest rainfall in the United States, excepting possibly upon some mountain tops, occurs upon the coast of Oregon and Washington Territory. But as already indicated this is the locality where we find the neutral axis, so to speak, of the alleged causes favoring respectively humidity and aridity, and where their effects are at a minimum or even at zero. Moreover, the westerly winds saturated with moisture here strike the coastwise mountains, and are suddenly thrown upward several thou-

* This general statement requires some qualification when applied to southern Arizona and southern New Mexico, though it is in the main applicable even there.

sand feet before they have had time to feel the heating effect of the land which is here very slight; and the precipitation is thus very copious. Descending to lower levels inland they soon become dry and produce a sub-arid climate.

The most frequent variants of climate are the great differences of altitude in different portions of the west. The mountain tops and summits of the plateaus are always well watered, and in any given latitude the rainfall increases or diminishes at a fairly definite rate with the altitude. But the variation of rainfall with altitude is by no means a simple ratio. Between 4500 and 6000 feet the difference in rainfall is not great; between 6000 and 7500 feet it is very considerable; between 7500 and 9000 it is still greater.

Moreover the rainfall is greater, *ceteris paribus*, in high latitudes than in low latitudes. In passing from the southern to the northern boundary, if we compare localities of equal altitudes along any given meridian, we shall find the rainfall steadily, though perhaps not uniformly increasing. This is an obvious consequence of the theory suggested.

Although no very great effects upon the general condition of aridity are here attributed to the depletion of moisture by the passage of the winds over mountain ranges, it is still true, no doubt, that highly important local effects are thereby produced. The rainfall at the eastern base of the Sierra Nevada, and for two hundred miles east of it, is most probably reduced very greatly by this cause. In the sink of the Humboldt River, the annual precipitation seldom reaches four inches, and may average not more than three inches. But as we pass eastward, beyond the *wake* of this range, its effects become gradually less; and long before the Wasatch is reached they have become inconsiderable. Since the Sierra Nevada is the longest, highest and widest of the individualized ranges of the Rocky system, its local effect upon the humidity of the plains and valleys lying immediately under its lee is greater than that of any other. But the same kind of effect is preceptible in some other ranges.

The discussion of the causes of local variations in climate might be almost indefinitely extended. Nothing more is designed here than to advert to one general cause of aridity which prevails over the entire region, and which everywhere exists, though it is often obscured, sometimes reversed and sometimes reinforced, by local causes.—*American Journal of Science.*

MEDICINE AND HYGIENE.

THE PROPER LIMITS OF PHYSICAL CULTURE.

BY W. B. SAWYER, M. D., KANSAS CITY, MO.

The questions of physical culture are pre-eminently those of this day. The college curricula of half a century ago contained no allusions to cultivation of the bodily powers, and society took no heed of how its members cared for them. The pendulum of fashion has swung far, however, away from this point of apathy and is rapidly approaching, if it has not reached, the opposite one of excess. To-day colleges, schools, towns, cities, and private societies are furnishing gymnasia for indoor exercises and expensive apparatus and stimulating prizes for excellence in outdoor athletics. The college graduate of the present is expected to be an expert oarsman, runner, or base-ball player, while nearly every young man is anxious to excel in feats of power. Will it not be well to question then what proper physical culture is and what needs it should aim to supply?

To begin with, all men are given, as part of the capital with which to gain a livelihood, bodies which, to say nothing of the wonderful beauty symmetry and nicety of their various arrangements, are precisely adapted for any calling in life which they may assume. They are also gifted, as the feature that distinguishes them from the brute creation, with intellect, and herein lies the point of their responsibility. The animal is guided in the care of his body only by instinct. When he is thirsty he drinks, when hungry seeks food, when frightened flees from the cause of his fear. All animals, saving man, have also provided for them, each in their separate kind, certain peculiar organs, functions and developments, which take for them, to a certain extent, the place of reasoning faculties. Thus the coat of horses, cattle, and fur-producing animals is thick for the cold of winter, is shed and comes again thinner when the warm months appear; certain classes of them are fitted entirely for a diet of herbs and others for meats alone, and to prevent the possibility of their mistaking the one for the other, or of manifesting any choice in the matter, they are each provided with teeth of such a kind as to admit of masticating the one, and not the other. So also to every created brute has been given just those qualities, organs, and instincts as are required by his peculiar characteristics. The bird has his light bones, broad wings and extensive lungs to prepare him for his aërial navigation. The water-fowl his broad web-feet for swimming, and the wonderful capacity for retaining air in the body.

Look over the entire range of animal nature in fact, and we see that whatever element the animal is to live and move in or upon, and whatever instinctive, natural traits he has, for the enjoyment and performance of them, he is provided

with the necessary appliances. But with animal nature, guided alone by instinct, within very narrow limits, there is no possibility of change, or of extending the range of the capabilities given by nature. The elephant can not fly, nor can the tiger eat grass like the ox. The bear of the pole can not live beneath the sun of the tropics, nor the fish of the sea upon dry land. Each brute must carry out the single purpose of his life, and must tread the one path marked out for him in the original plan. When we consider man, however, we find another structure and functions, and vastly greater capabilities.

To the body, with its organs and functions and all the so-called natural instincts, is added the mind with all its powers of thought, will and passion. With a body, not especially fitted for any one sphere of activity, or style of life, but wonderfully adapted for all, is joined an intellect to provide the means for any sort of action or change, a will to carry out any proposed deflection from ordinary animal life and a power of judgment to decide what to do for the body at all times, and in all places, thus to protect it from what might be the direful consequences of extensive changes. To illustrate—instead of being furnished with a covering of hair, feathers, or scales, man is given ability to make clothing for himself, and to adapt it to the conditions of the surrounding atmosphere. Without being limited in his diet to herbs or to flesh, he is given his choice, and delicate sensibilities of taste, with reason to guide it. He is not made swift of foot to flee from his enemies; not provided with natural weapons to protect himself from them, but is given inventive powers whereby he can procure for himself the swiftest locomotion and the surest tools of defense.

Now this connection of mind and matter—and all philosophy since the world began has never been able to say how or where it is made—is not a simple copartnership, entered into by the mind on the one side and the body on the other, for mutual benefit, and from which either partner may withdraw at pleasure, but wherever it is made, or however the bond is cemented, it is absolute, indissoluble and ending only with death. It is a union in which the one party is dependent on the other, and when one suffers the other feels the result. In this is the need, and in this the reason for physical culture. Men can not forget their bodies, for upon them equally with dependence upon their mental qualifications depend the hopes they may have for the highest attainments. An even, perfect balance of all powers is the thing to be sought after. A fine mind in a misshapen, weak, or undeveloped body is the mournful sight, too often seen, which comes as a result of a neglect of some law of nature, and a huge body, or even a graceful and highly developed one, coupled with a shallow brain is just as surely the result of negligence or malicious training. Remembering then, that when we attempt physical culture our object should be to make the body the fit companion and dwelling-place of a well-cultured intellect, and that that intellect may have the fullest powers of endurance, quickness and energy at its command, and that when we seek mental culture we are but perfecting the engine that it may produce the most, and the most perfect results from its machinery, the body, we are prepared to consider what constitutes proper physical culture and how it may be

attained. When we speak of physical culture, in the minds of many will at once arise the remembrance of some great athlete we may have seen or known; and vision of red, brawn, sinewy limbs, great knotted muscles, and wondrous feats of arms and legs will appear. But true physical culture is a term whose significations should not be narrowed to the consideration of a culture whose end is only the development of one part and phase of the physique. It is the cultivation to the furtherest extent in the safest way, and to the full possibility, of every organ and function of the body. The hardest limbs may be but the overgrown and over-educated accompaniment of a weak heart or dyspeptic stomach, or may lead to them. The swiftest runner may forget that the lungs need training as well as the legs, and a consumptive may thus have cause to remember his races, and repent them. But more likely then either, the stomach, lungs or heart to be forgotten in the effort for high bodily powers, are the most important organs of all. The nerves doing their duties as messengers and stimulators, from the commander, the brain, to its subjects the muscles, silently motionlessly, and with all the mystery of a perfect telegraph system, are most liable to be forgotten and left to care for themselves, or more often, are taxed beyond their capabilities and irreparably injured for life. The strain must be equal and every function carried systematically to its fullest development.

Physical culture should keep pace with mental development, bodily exercise accompany and supplement intellectual work. The amount of physical exercise should be just enough and of just such a kind as will rest the mind and divide with it the burden of life and work. It should be neither prolonged nor excessive, and should be constant and regularly taken. Each brain must be the judge of how much and what variety of exercise the body that houses and serves it demands. The hard worked clerk who stands for hours in the close atmosphere of a store does not require the gymnasium as much as he does the open air, nor exercise for his legs as much as he does for his lungs, while many a busy man whose calling keeps him in the street can find exactly what he needs only on the horizontal bars or with the Indian clubs. The part to be worked and stimulated should be the one most neglected. Yet the proper care of the body means care of the whole body, and watch must be kept on all sides lest some function be overdone at the expense of some equally important one. The safe course is to test them all from time to time and build up and revivify the weaker ones as occasion may demand, not forgetting that moderation is a physical as well as a moral virtue.

MEISO.

BY PROF. D. P. PENHALLOW, LATE OF THE IMPERIAL AGRICULTURAL COLLEGE OF JAPAN.

It is well known that the Japanese are a rice-eating people, with whom this article, Meiso, is perhaps, the most important of all their foods, but it is not so generally known that the flesh of animals could hardly be considered a regular

article of food until within the past few years, and even now, with the great mass of the people, meat is seldom used. Thus for centuries, these people have lived almost wholly without that which western people consider so important a source of nitrogen. It seems, however, that the demands of Nature were recognized and met by obtaining from the vegetable kingdom what they failed to secure from the animal, and thus it is we find them consuming enormous quantities of beans prepared in a great variety of ways. Some of the important preparations from beans are cheese, or tofu—a white, curdy mass strongly resembling cottage cheese, unflavored with salt and held in high estimation. It is prepared in a variety of of ways, but almost invariably forms a part of every meal as a constituent of soup: Cake—a stiff, jelly-like confection made by straining boiled beans and incorporating with a large proportion of sugar. Pickles—beans in the pod and frequently on the stem, pickled in a strong brine; they are eaten without further preparation. Sugared Beans—roasted beans enveloped in a heavy coating of sugar and sold as a confection. Shoyu, or Soy—a liquid of dark color and salty flavor, made by fermenting a mixture of salt, beans and roasted wheat or barley. It is largely eaten with fish and rice. There are other modes of preparation which we will pass over with the exception of Meiso, which forms the subject of this article.

The pasty mass manufactured and sold under this name, constitutes one of the most important of the preparations from beans, and enters largely into the diet of all clases as a basis for soup, or, in various forms, as a sauce for fish and meat. In composition it consists of

Salt	4.5 to=2.30	bushels.
White Beans	1 koku=5.13	"
Rice	4 to=2.05	"

Salt.—The salt employed is of a very crude sort. It is obtained from sea water by evaporation under the influence of solar heat, and as no attempts are made to secure any special degree of purity, it is consequently contaminated with other salts and its specific value thereby lessened. Sticks, straw—especially from the coarse bags in which it is transported—and dirt are also always to be found and as no efforts to cleanse or purify, beyond removal of the larger fragments of straw, etc., are made at the factory, the product into which such salt enters has a rather uninviting appearance. It is always used dry.

Beans.—The ordinary white beans appear to be used in preference to any others. They are prepared by boiling for about six hours, when the fire is drawn and they are allowed to cool in the boiler. The next morning they are removed from the boiler and placed in mash boxes which measure 10x3x1 feet, where they are thoroughly reduced and mixed with the rice and salt by means of a round pole used as a pestle.

Rice.—White rice, or that which has been well cleaned, is soaked in cold water for two days. It is then well drained and transferred to a boiler containing fresh water, when it is steamed for three hours. While yet hot, it is taken to

warm room and allowed to remain under the influence of a warm, moist air for four day , when the whole is found to be covered with an abundant growth of fungus.

The room in which this operation is performed, usually measures about 10x20 feet, is constructed of mud walls—eight or ten inches in thickness, and is made as close as possible with the exception of one small window to admit light for the workmen, and a door through which to enter,. The only moisture in the room is that which comes from the moist rice, but a constant temperature of 80° F. is maintained by means of a large charcoal fire at each end of the room. It is regarded that a warm, moist air undisturbed by draughts, is quite essential to the success of the operation, though darkness is not deemed requisite, the absence of windows being more a matter of economy than anything else. The production of the fungus is usually regarded as the critical part of the whole manufacture, and failure sometimes occurs. No reason could be obtained from the Japanese why the subsequent fermentation is dependent upon the presence of the fungus; that its production is an essential part of the process, was all the information that could be obtained.

At the end of four days, the rice is taken out into a large airy room and spread upon straw mats, 3x6 feet, and allowed to cool for one and one-half hours. It is then transferred to small trays which measure 18x8x1½ inches, for convenience in handling, when it is allowed to cool as rapidly as it can. Whether the rice now dries or remains moist, appears to be a matter of indifference. As soon as thoroughly cooled, it is incorporated with the salt and beans. It is generally customary, however, to prepare the rice in large quantities once in four days, and thus have a stock always on hand. In that case, as soon as cooled, it is mixed with the salt and placed in large storage vats where it is tamped solid by the feet, and will then keep without trouble for two months.

When all the ingredients have been thus prepared, they are placed, cold, in the mixing boxes already described, and thoroughly incorporated into a stiff, pasty mass by means of a long mixing rod. This mixture is then placed in large vats having a capacity of about seventeen koku or eighty-seven bushels. Here it is packed solid by the feet and allowed to undergo a very slow fermentation. Every effort is made to keep the temperature of the mass down as low as possible, and if, during the summer, the heat of fermentation gets too great, the whole mass spoils. It is then mixed with roasted wheat and by further fermentation converted into shoyu or soy. Sometimes the mixture fails to ferment properly, when it is taken out and mixed with a fresh portion of beans. The fermentation is allowed to continue six months in summer and eight months in winter, at the end of which time the meiso is ready for the market.

The result of these various operations is a stiff, pasty mixture of repulsive appearance and disagreeably sour odor, and though it would hardly find favor with Americans or Europeans, possibly excepting epicures, it seems to be in great demand with the Japanese.

The factory where these facts were obtained, employs six men, and the annual produce amounts to from 900 to 1,000 koku, equal to 4,617 to 5,130 bushels. The cost of the various ingredients and the finished product is as follows: *

Beans, 1 koku—5.13 bu.	6	yen†
Rice, 1 koku	10	"
Salt, 1 koku	5.40	"
Total cost of Meiso per koku	7.13	"
Market price per koku	13.20	"

The moldy rice, prepared as described, constitues the yeast of the Japanese and is used for all the purposes, including bread-making, for which we would employ ordinary yeast. Its production is therefore of considerable importance, as upon it depends the manufacture of meiso, saki, (fermented liquor,) vinegar, and shoyu. It therefore becomes evident that the principal interest of this entire manufacture centers in the fungus which develops upon the rice, because of the variety of forms which may be developed from its spores under different conditions of warmth and moisture, and, also, exposure to the air.

In order to obtain some satisfactory evidence on this interesting subject, the various products—moldy rice, meiso, yeast and vinegar—were submitted to microscopical examination.

A sample of meiso was taken from a vat where fermentation had been in progress for some time. It was noticed that the temperature was so low, that the whole mass felt cold to the hand, and thus whatever fermentation was in progress, must have been going on at a very slow rate. On examination, there appeared numerous spore-like bodies, similar in form and size to the spores from the moldy rice, which they doubtless were. In addition, there were many short and irregularly branched filaments in all stages of growth from the spore. Nothing was seen which could be called yeast-plant proper, or *S. cerivisicæ.*

A sample of freshly made vinegar, showed the liquid to contain a very large number of spermatia-like bodies, while masses of the true vinegar-plant were also numerous. The cells of these measured 1-7000 of an inch in diameter. No true yeast-plant was to be found, though this may possibly have been due to the degree of saccharine exhaustion as well as the low temperature of the fermentation. A sample of vinegar, containing a good surface growth of the vinegar-plant, was kept for three weeks in the hope that fruit might appear and thus furnish one more link in the chain of evidence; but none appeared, although the net-work of cells constantly and rapidly increased, and further observations were interrupted by departure for home.

Yeast made in the ordinary way, but using the moldy rice to start the ferment, showed the familiar forms of the true yeast-plant. The fungus on the moldy rice, proved to be our old friend *Penicilleum.*

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* Prices for 1880; probably somewhat higher at present.

† Yen, gold, is equal to the U. S. dollar.

These observations furnish us with a practical illustration of the fact that these vegetable structures of low degree of organization, are not necessarily constant in form and structure, but are liable to vary greatly under different conditions of temperature, moisture and exposure, and that they are associated with fermentation of varying rapidity as well as with products which are more or less dissimilar. They furnish one instance of the effect which environment has upon the individual.

BOOK NOTICES.

ANTHROPOLOGY. By Edward B. Tylor, D. C. L., F. R. S., with illustrations; pp. 448, 12mo., New York, D. Appleton & Co., 1881.

This work is announced as "an Introduction to the Study of Man and Civilization" and it is at least safe to say that no better one has been presented by any author. It covers the whole subject of the science of Man and, without dry and burdensome technicalities, places before the student all that is necessary for him to know before commencing his own investigations or the study of elaborate works devoted to special branches or departments of Anthropology.

The scope of the work is fully shown by the titles of the chapters: Man, Ancient and Modern; Man and other Animals; Races of Mankind; Language; Language and Race; Writing; Arts of Life; Arts of Pleasure; Science; The Spirit World; History and Mythology, and Society. All of these subjects are fully illustrated with appropriate and excellent engravings, and the author has presented his theme in a logical and progressive form from beginning to end of the volume. No writer of the present day has had greater experience nor made more careful researches in this field, nor is any more happy in expressing himself acceptably to the general reader. His introductory chapters on Man, Ancient and Modern, and on Man and other Animals, bring the whole subject before the student in a condensed yet comprehensive form, and serve as a foundation, not only for his (the author's,) subsequent chapters, but also for the student to build upon, no matter how extensive his future researches may be.

To any one intending to make Anthropology a specialty, no work that we know of is so fitting as a preliminary text book and guide.

ILLUSIONS: A PSYCHOLOGICAL STUDY. By James Sully, New York; D. Appleton & Co., 1881. For sale by M. H. Dickinson, $1.50.

This work is the thirty-third volume of the International Scientific Series, and is one of the most interesting of that valuable series. The author takes a wide survey of the field of error, embracing in its view not only the illusions of sense dealt with in treatises on physiological optics, etc., but also other errors

familiarly known as illusions and resembling the former in their structure and mode of origin. The points treated are as follows: The Study of Illusion; the Classification of Illusion; Illusions of Perception, general, active and passive; Dreams; Illusions of Introspection; Other Quasi-Presentative Illusions; Errors of Insight; Illusions of Memory; Illusions of Belief; Results. The whole contained in twelve chapters, covering three hundred and seventy-two pages.

Starting with statement that the flattering supposition of common sense that illusion is essentially an incident in abnormal life is so erroneous that many regard it as the natural condition of mortals, he takes the middle ground that most men are sometimes liable to illusion. From this position he follows the subject as above indicated, having due regard to the physiology as well as the pathology of mind. The chapter on Dreams will be found especially interesting to the general reader from the comprehensive and practical manner in which the subject is handled. Various theories of dreams are considered, but the conclusion is reached that they are to a large extent the semblance of external perceptions, their materials drawn from our waking experiences and that they are largely intelligible by help of the physiological and psychological principles previously considered. In explaining dreams the the condition of the organism in sleep is first set forth, then the dream state, the causes of dream illusions, such as the action of external and internal stimuli; dream exaggeration, dream hallucinations, effects of direct and indirect central stimulation, combination of dream elements, incoherence of dreams, their coherence, the lyrical element in dreams, etc.

The whole book is the work of a careful student, a skillful physiologist and a logical thinker, and it is full of valuable information and suggestions.

THE OLD TESTAMENT IN THE JEWISH CHURCH. By W. Robertson Smith, M. A. 12mo., pp. 446; D. Appleton & Co., New York, 1881. For sale by M. H Dickinson, $1.75.

Biblical criticism in the scholarly sense includes the most careful examina tion and weighing of every expression of every prophet, historian, psalmist an apostle whose writings are found in the Bible; differing in the widest degree fro the Bible reading of the ordinary student whose search is either wholly devotiona or perhaps for doctrinal purposes. In the first case the reader puts himself a far as possible in the exact position of the writer and interprets his words an thoughts by means of a full comprehension of his surroundings; tracing the su cessive steps of religious progress in the world from the simple sacrificial offering of Cain and Abel to the vicarious sacrifice of Jesus Christ; in this way arriving a an exhaustive and complete, critical knowledge of the Bible. In the other cas certain portions are selected, which, on account of their precious promises or the pathos, or their wondrous revelations of the future life, or some other practic quality, arouse the sympathies or strengthen the faith of the reader. Necessari this latter manner of study leaves out of consideration a large portion of tl

Bible which does not direct itself immediately to the emotions, and is essentially imperfect.

The work before us is devoted to pointing out the true method of Biblical study, being the substance of a series of lectures delivered by the author in Edinburgh and Glasgow during the first three months of 1881. The points discussed are Criticism and the Theology of the Reformation; Christian Interpretation and Jewish Tradition; The Scribes; The Septuagint; The Canon; The History of the Canon; The Psalter; The Traditional Theory of the Old Testament History; The Law and the History of Israel before the Exile; The Prophets; The Pentateuch; The First Legislation; The Deuteronomic Code and Levitical Law.

In all of these the scholarship of the author manifests itself clearly, while his expositions of doubtful passages are palpably clear and conclusive. We regard the word as one of the most interesting of the kind that we have ever seen, well worthy of the study of all Bible readers and teachers.

Farm festivals. By Will Carleton; illustrated; New York. Harper & Brothers, 1881. For sale by M. H. Dickinson, $2.00.

Will Carleton has become by common consent, *par excellence*, the acknowledged ballad writer of America. His series of Farm Ballads was and is widely read, and the present volume can but add to his reputation in this respect. His subjects are well chosen and his treatment of them will bring freshly to the memory of his older readers, at least, scenes of their youth long forgotten perhaps, the arousing of which will be grateful and care-dispelling. Many gems of genuine poetry gleam among his verses, and the whole work will be found bright and attractive in all respects.

Journal of a farmer's daughter. By Elaine Goodale; pp. 183, 12mo.; G. P. Putnam's Sons, New York, 1881. For sale by M. H. Dickinson, $1.00.

The papers comprised in this volume were principally published in the *Christian Union* under the title of a "A Summer Journal," and as such attracted considerable attention, from the elegance of the writer's style and the truthfulness of her descriptions. Graceful poetry and dainty prose combine to make the book readable and attractive. The period covered is from April 2nd to November 30th, and a page or two is given to nearly every day of this time; all filled with appropriate, glowing descriptions, graceful pen pictures of and sparkling allusions to the beauties of nature in the country.

For a city reader, penned up in a narrow home and hemmed in by dusty streets and dingy warehouses, there can be no more pleasant or piquant reading.

OTHER PUBLICATIONS RECEIVED.

Report of Professor Spencer F. Baird, Secretary of the Smithsonian Institution, for 1881; A Synopsis of the Scientific Writings of Sir William Herschel, prepared by Prof. Edward S. Holden and Charles S. Hastings; An Account of Recent Progress in Geology and Mineralogy for the years 1879 and 1880, by Geo. W. Hawes, Ph. D., curator of the National Museum; An Account of Recent Progress in Physics and Chemistry for the years 1879 and 1880, by Prof. Geo. F. Barker; An Account of Recent Progress in Astronomy for the years 1879 and 1880, by Prof. E. S. Holden; Bulletin No. 6, General Index and Supplement to the Nine Reports on the Insects of Missouri, by Prof. Charles V. Riley, M. A., Ph. D.; Apportionment under the Tenth Census of the U. S., with remarks by Hon. S. S. Cox, M. C.; Fourteenth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology, Prof. F. W. Putnam, Curator; Explorations in Idaho and Montana in 1878, Prof. E. L. Berthoud; Science Teaching in District Schools, Prof. Paul Schweitzer, Ph. D.; Priced and Classified List of Works on Political Economy and Political Science, W. G. Sumner, David A. Wells, W. E. Foster, R. L. Dugdale and G. H. Putnam; Seventh Annual Report of the Board of Education of District No. 1, Denver, Colorado.

SCIENTIFIC MISCELLANY.

FIFTY YEARS' PROGRESS IN SCIENCE.

BY SIR JOHN LUBBOCK, PRESIDENT OF THE BRITISH ASSOCIATION.

* * Certainly this is an opportunity on which it may be well for us to consider what have been the principal scientific results of the last half-century, dwelling especially on those with which this Association is more directly concerned, either as being the work of our own members, or as having been made known at our meetings. * * My best course will be to take our different Sections one by one, and endeavor to bring before you a few of the principal results which have been obtained in each department.

The Biological Section is that with which I have been most intimately associated, and with which it is, perhaps, natural that I should begin.

Fifty years ago it was the general opinion that animals and plants came into existence just as we now see them. We took pleasure in their beauty; their adaptation to their habits and mode of life in many cases could not be overlooked or misunderstood. Nevertheless, the book of Nature was like some richly illum-

inated missal, written in an unknown tongue; the graceful forms of the letters, the beauty of the coloring, excited our wonder and admiration; but of the true meaning little was known to us; indeed we scarcely realized that there was any meaning to decipher. Now glimpses of the truth are gradually revealing themselves; we perceive that there is a reason—and in many cases we know what that reason is—for every difference in form, in size and in color; for every bone and every feather, almost for every hair. Moreover, each problem which is solved opens out vistas, as it were, of others perhaps even more interesting. With this great change the name of our illustrious countryman, Darwin, is intimately associated, and the year 1859 will always be memorable in science as having produced his great work on "The Origin of Species." In the previous year he and Wallace had published short papers, in which they clearly state the theory of natural selection, at which they had simultaneously and independently arrived. We cannot wonder that Darwin's views should have at first excited great opposition. Nevertheless from the first they met with powerful support, especially, in this country, from Hooker, Huxley and Herbert Spencer. The theory is based on four axioms:—

"1. That no two animals or plants in nature are identical in all respects.

"2. That the offspring tend to inherit the peculiarities of their parents.

"3. That of those which come into existence, only a small number reach maturity.

"4. That those, which are, on the whole, best adapted to the circumstances in which they are placed, are most likely to leave descendants."

Darwin commenced his work by discussing the causes and extent of variability in animals, and the origin of domestic varieties; he showed the impossibility of distinguishing between varieties and pointed out the wide differences which man has produced in some cases—as, for instance, in our domestic pigeons, all unquestionably descended from a common stock. He dwelt on the struggle for existence (which has since become a household word), and which, inevitably resulting in the survival of the fittest, tends gradually to adapt any race of animals to the conditions in which it occurs

While thus, however, showing the great importance of natural selection, he attributed to it no exclusive influence, but fully admitted that other causes—the use and disuse of organs, sexual selection, etc.—had to be taken into consideration. Passing on to the difficulties of his theory he accounted for the absence of intermediate varieties between species, to a great extent, by the imperfection of the geological record. Here, however, I must observe that, as I have elsewhere remarked, those who rely on the absence of links between different species really argue in a vicious circle, because wherever such links do exist they regard the whole chain as a single species. The dog and jackal, for instance, are now regarded as two species but if a series of links were discovered between them they would be united into one. Hence in this sense there never can be links between any two species, because as soon as the links are discovered the species are united. Every variable species consists, in fact, of a number of closely connected links.

But if the geological record be imperfect, it is still very instructive. The further paleontology has progressed the more it has tended to fill up the gaps between existing groups and species, while the careful study of living forms has brought into prominence the variations dependent on food, climate, habitat, and other conditions, and shown that many species long supposed to be absolutely distinct are so closely linked together by intermediate forms that it is difficult to draw a satisfactory line between them. Thus the European and American bisons are connected by the *Bison priscus* of Prehistoric Europe; the grizzly bear and the brown bear, as Busk has shown, are apparently the modern representatives of the cave bear; Flower has pointed out the paleontological evidence of gradual modification of animal forms in the Artiodactyles; while among the Invertebrata, Carpenter and Williamson have proved that it is almost impossible to divide the Foraminifera into well-marked species; and, lastly, among plants, there are large genera, as, for instance, *Rubus* and *Hieracium*, with reference to the species of which no two botanists are agreed.

The principles of classification point also in the same direction, and are based more and more on the theory of descent. Biologists endeavor to arrange animals on what is called the "natural system." No one now places whales among fish, bats among birds, or shrews with mice, notwithstanding their external similarity; and Darwin maintained that "community of descent was the hidden bond which naturalists had been unconsciously seeking." How else, indeed, can we explain the fact that the framework of bones is so similar in the arm of a man, the wing of a bat, the fore-leg of a horse, and the fin of a porpoise—that the neck of a giraffe and that of an elephant contain the same number of vertebræ?

Strong evidence is, moreover, afforded by embryology; by the presence of rudimentary organs and transient characters, as, for instance, the existence in the calf of certain teeth which never cut the gums, the shrivelled and useless wings of some beetles, the presence of a series of arteries in the embryos of the higher Vertebrata exactly similar to those which supply the gills in fishes, even the spots on the young blackbird, the stripes on the lion's cub; these, and innumerable other facts of the same character, appear to be incompatible with the idea that each species was specially and independently created; and to prove, on the contrary, that the embryonic stages of species show us more or less clearly the structure of their ancestors.

Darwin's views, however, are still much misunderstood. I believe there are thousands who consider that according to his theory a sheep might turn into a cow, or a zebra into a horse. No one would more confidently withstand any such hypothesis, his view being, of course, not that the one could be changed into the other, but that both are descended from a common ancestor.

No one, at any rate, will question the immense impulse which Darwin has given to the study of natural history, the number of new views he has opened up, and the additional interest which he has aroused in, and contributed to, Biology. When we were young we knew that the leopard had spots, the tiger was striped, and the lion tawny; but why this was so it did not occur to us to ask; and if we

had asked no one would have answered. Now we see at a glance that the stripes of the tiger have reference to its life among jungle-grasses; the lion is sandy, like the desert; while the markings of the leopard resemble spots of sunshine glancing through the leaves. Again, Wallace in his charming essays on natural selection has shown how the same philosophy may be applied even to birds' nests—how, for, instance, open nests have led to the dull color of hen birds; the only British exception being the kingfisher, which as we know, nests in river-banks. Lower still, among insects, Weismann has taught us that even the markings of caterpillars are full of interesting lessons; while, in other cases, specially among butterflies, Bates has made known to us the curious phenomena of mimicry.

The science of embryology may almost be said to have been created in the last half-century. Fifty years ago it was a very general opinion that animals which are unlike when mature, were dissimilar from the beginning. It is to Von Baer, the discoverer of the mammalian ovum, that we owe the great generalization that the development of the egg is in the main a progress from the general to the special, that zoölogical affinity is the expression of similarity of development, and that the different great types of animal structure are the result of different modes of development—in fact, that embryology is the key to the laws of animal development.

Thus the young of existing species resemble in many cases the mature forms which flourished in ancient times. Huxley has traced up the genealogy of the horse to the Miocene Anchitherium, and his views have since been remarkably confirmed by Marsh's discovery of the Pliohippus, Protohippus, Miohippus and Mesohippus, leading down from the Eohippus of the early Tertiary strata. In the same way Gaudry has called attention to the fact that just as the individual stag gradually acquires more and more complex antlers: having at first only a single prong, in the next year two points, in the following three, and so on; so the genus, as a whole, in Middle Miocene times, had two pronged horns; in the Upper Miocene, three; and that it is not till the Upper Pliocene that we find any species with the magnificent antlers of our modern deer. It seems to be now generally admitted that birds have come down to us through the Dinosaurians, and, as Huxley has shown, the profound break once supposed to exist between birds and reptiles has been bridged over by the discovery of reptilian birds and bird-like reptiles; so that, in fact, birds are modified reptiles. Again, the remarkable genus Peripatus, so well studied by Moseley, tends to connect the annulose and articulate types. Again, the structural resemblances between Amphioxus and the Ascidians had been pointed out by Goodsir; and Kowalevsky in 1866 showed that these were not mere analogies, but indicated a real affinity. These observations, in the words of Allen Thompson, "have produced a change little short of revolutionary in embryological and zoölogical views, leading as they do to the support of the hypothesis that the Ascidian is an earlier stage in the phylogenetic history of the mammal and other vertebrates."

The larval forms which occur in so many groups, and of which the Insects afford us the most familiar examples, are, in the words of Quatrefages, embryos,

which lead an independent life. In such cases as these external conditions act upon the larvæ as they do upon the mature form; hence we have two classes of changes, adaptational or adaptive, and developmental. These and many other facts must be taken into consideration; nevertheless naturalists are now generally agreed that embryological characters are of high value as guides in classification, and it may, I think, be regarded as well-established that, just as the contents and sequence of rocks teach us the past history of the earth, so is the gradual development of the species indicated by the structure of the embryo and its developmental changes.

When the supporters of Darwin are told that his theory is incredible, they may fairly ask why it is impossible that a species in the course of hundreds of thousands of years should have passed through changes which occupy only a few days or weeks in the life-history of each individual?

The phenomena of yolk-segmentation, first observed by Prevost and Dumas, are now known to be in some form or other invariably the precursors of embryonic development; while they reproduce, as the first stages in the formation of the higher animals, the main and essential features in the life-history of the lowest forms. The "blastoderm" as it is called, or first germ of the embryo in the egg, divides itself into two layers, corresponding, as Huxley has shown, to the two layers into which the body of the Cœlenterata may be divided. Not only so, but most embryos at an early stage of development have the form of a cup, the walls of which are formed by the two layers of blastoderm. Kowalevsky was the first to show the prevalence of this embryonic form, and subsequently Lankester and Haeckel put forward the hypothesis that it was the embryonic repetition of an ancestral type, from which all the higher forms are descended. The cavity of the cup is supposed to be the stomach of this simple organism, and the opening of the cup the mouth. The inner layer of the wall of the cup constitutes the digestive membrane, and the outer the skin. To this form Haeckel gave the name Gastræa. It is, perhaps, doubtful whether the theory of Lankester and Haeckel can be accepted in precisely the form they propounded it; but it has had an important influence on the progress of embryology.

[*To be Continued*]

INDUSTRIES OF SWEDEN AND NORWAY.

Although in Norway and Sweden there are many mines and mills, most of the people gain their living either out of the soil or the sea. The farmer in either country is a marvel of industry and thrift; he would live upon what an American farmer wastes, and live more comfortably than our farming population do, as a rule. The amount of labor performed at the special dairy farms, to which cattle are driven in summer, generally by girls, would horrify a western maiden; but the Swedish and Norwegian girls thrive on it, enjoying rare good health and

onsequent happiness. Still more exacting is the home care of cattle in winter, hen much of the food must be specially prepared. On some soil that here ould be condemned as good for nothing, fair crops are grown and harvested in he short summer, while in the southern provinces the yield is equal to that of nodel farms in America.

The maritime statistics of the two countries, and of Norway in particular, re simply staggering. Last year more than a thousand Norwegian vessels enered the port of New York, and seven times as many were busy elsewhere. More han sixty thousand sailors man these vessels, and yet Norwegian sailors are nunerous in the merchant navy of almost every other country. About a hundred nd twenty thousand Norwegians are engaged in the fisheries. The author miutely describes the great fishing stations of Norway, and here, as elsewhere, is truck by the attention paid by the government to all its resources. Every fishng station has a superintendent, appointed by the government, and the date of eginning the season's work, the time of starting out for the day, and even the laces in which the fish are prepared for market, are determined by him; but the fficer's duties seem to consist principally in preventing confusion or bad feelng. No liquor is sold at fishing stations, and yet the men, who are directly in he path of all the "American weather" that crosses the Atlantic, are a remarkaly healthy and vigorous set of fellows; they wear good clothes, too, which is ot done by fishermen in general. To their abstemiousness must be attributed he lack of strife; during a long visit to the fishing stations the author saw no ighting, and did not hear a single oath. No fishing is permitted on Sunday. Drunkenness and profanity are rare everywhere in Scandinavia; there seems to e absolutely no idle, non-producing, dangerous class, such as is the mainstay f vice in every other European country. At fairs and feasts there is a great deal f drinking, but the period is brief, and the fun never culminates in fighting.—*ohn Habberton, in Harper's Magazine for November.*

RAILROAD STATISTICS.

Poor's Manual gives some interesting railroad statistics. The mileage at the lose of 1880, in this country, was 93,671, a gain of 8.2 per cent. for the year; he gross earnings were $615,401,931; net earnings, $255,193,426; each showng an increase of 16 per cent. over the previous year. The dividends amounted o $77,115,411, a gain of 25 per cent. compared with 1879—while the increased ost shown a gain of 5.4 per cent. over the year 1879. The growth of our raiload system during the past ten years has been very rapid. In 1870 there were 2,914 miles of railroad, and in 1880 there were 93,671. The gross earnings in 870 were $9.30 per capita; in 1880, $12.27 per capita, showing that while the opulation has increased 23 per cent. in ten years, the gross earnings on railroads ave increased in the same time 74 per cent. The freight charges on railroads ave been reduced in that time from an average on the great leading lines of

1.682 cents per ton per mile, to 0.919 cents per ton per mile, showing that in th ten years the earnings have increased 74 per cent. on a decreased freight charg of 83 per cent.

A CORRECTION.

BY PROFESSOR H. A. REID.

In the REVIEW for October, page 365, occurs the "Synoptic Calendar o Creation," in which there is an important omission, but altogether my own fault I wish to have it printed in its complete form, as connected with my article o "Creational Progress," and therefore present it here again with the omitted part supplied.

THE SYNOPTIC CALENDAR OF CREATION.

CALENDAR TO BE READ FROM THE BOTTOM UPWARD.	THE SPIRITUAL *KINGDOM.*	7	God; angels; "ministering spirits;" "spirits o just men made perfect;" the "spiritual man" o the Bible. Also, evil spirits, "powers of dark ness," the "familiar spirits" so rigorously out lawed by the laws of Moses.
	THE ANIMAL *KINGDOM.*	6	All animal tissues, substances and products, in cluding the animal, MAN, of science, or "carna man" of the Bible.
	THE VEGETABLE *KINGDOM.*	5	All vegetable growths, substances and products
	THE MINERAL *KINGDOM.*	4	All mineral substances, whether solid, subfluid or in solution, that have never formed any part o any vitalized structure.
	THE ELEMENTAL *KINGDOM.*	3	Preterrestrial elements; nebulous matter, what ever it may be; also, oxygen, hydrogen, nitrogen ozone, etc.
	THE POTENTIAL *KINGDOM.*	2	Those impalpable and imponderable *forces* i nature which physical science does recognize, bu can in nowise explain or account for—as, electr city, magnetism, gravitation, heat, vitessence will-power, volition, etc.
	THE DEIFIC *KINGDOM.*	1	That Supreme Power which is the ultimate c absolute Great First Cause—however it may b conceived to exist. or by whatever name callec The "Jehovah," the "Living God," the "Hea enly Father" of the Bible.

In the first publication of this calendar, as above referred to, the first tw kingdoms were inadvertently omitted. It doubtless fills the popular thoug without them; but for fundamental grasp and philosophical completeness, the are necessary.

WHAT VOLCANOES ARE NOT.

"What is a volcano?" This is a familiar question, often addressed to us in our youth, which "Catechisms of Universal Knowledge" and similar school manuals have taught us to reply to in some such terms as the following: "A volcano is a burning mountain, from the summit of which issue smoke and flames." This description, says Professor Judd, is not merely incomplete and inadequate as a whole, but each individual proposition of which it is made up is grossly inadequate and, what is worse, perversely misleading. In the first place, the action which takes place at volcanoes is not "burning," or combustion, and bears, indeed, no relation whatever to that well-known process. Nor are volcanoes necessarily "mountains" at all; essentially they are just the reverse—namely, holes in the earth's crust, or outer portion, by means of which a communication is kept up between the surface and the interior of our globe. When mountains do exist at centers of volcanic activity, they are simply the heaps of materials thrown out of these holes, and must, therefore, be regarded not as the causes but as the consequences of volcanic action. Neither does this action always take place at the "summits" of volcanic mountains when such exist, for eruptions occur quite as frequently on their sides or at their base. That, too, which popular fancy regards as "smoke" is really condensing steam or watery vapor, and the supposed raging "flames" are nothing more than the glowing light of a mass of molten material reflected from these vapor clouds.

The name of volcano has been borrowed from the mountain Vulcano, in the Lipari Islands, where the ancients believed that Hephæstus, or Vulcan, had his forge. Volcanic phenomena have been at all times regarded with a superstitious awe, which has resulted in the generation of such myths as the one just mentioned, or of that in which Etna was said to have been formed by the mountains under which an angry god had buried the rebellious Typhon. These stories changed their form, but not their essence, under a Christian dispensation, and Vulcano became regarded as the place of punishment of the Arian Emperor Theodosius, and Etna as that of Anne Boleyn, who had sinned by perverting the faith of King Henry VIII.—*From "Volcanoes, their Action and Distribution," in Popular Science Monthly for November.*

THE FORESTRY WORK OF THE TENTH CENSUS.

BY SYLVESTER BAXTER.

Up to the present time there has been but a vague conception of the extent and value of one of the most important sources of the prosperity of the United States. It seems the more strange when it is considered that this great item in the nation's assets is not buried in the earth, like its mineral wealth, but stands proudly upon the surface, like a mighty host, seen of all men. The entire wel-

fare of a country is more identified with the forests that cover it than with any other feature of the earth's surface. The trees are the kindest friends of the soil they are the guardians of its fertility; they protect the fields from devastating floods, and cherish the springs that feed the streams. Without them a land becomes an arid desert, and its people are debased to barbarism and poverty Great desolated tracts in Asia, Africa, and along the Eastern Mediterranean were once blooming and garden-like; but when the trees were cut away the dryads avenged themselves. Therefore it is fitting that in the grand taking account of stock in the national storehouse that occurs every decade, the forest wealth of the country should at last be accorded its proper place.

Although the statistics concerning the forests of most of the European countries are generally full and accurate, the institution of the forestry division of the tenth census of the United States forms the first attempt to obtain such information by means of the census work of any country. In laying out the work of his bureau, General Francis A. Walker, the superintendent of the census, decided to undertake an investigation into the extent of the forest covering of the country as related to agriculture; into the forest wealth as related to manufactures, to railway transportation, and to the domestic supply of fuel; and into the operation of the lumbering industry as pursued in the principal districts of cutting and export. The scope of the investigation comprises the chief characteristics of the forest flora of each section of the country, an account of the various woods in their adaptation to industrial and domestic uses, and the methods in vogue in the various parts of the country for the protection or restoration of the forest growth —*November Atlantic.*

INDIAN SUMMER.

The tranquil river glideth to the sea,
    Thro' purple haze the golden sunbeams fall;
The white sails glimmer by us silently—
    The hush of dreamland lieth over all.

Our spirits live like flowers in the light,
    Nor feel nor fear the sting of earthly pain,
For dread the shadows of the coming night,
    In peaceful rest we lie; all toil is vain.

Vain are the hopes and fears and doubts of youth,
    We dream our lives away, and ask not why;
Vain all our lofty aspirations after truth;
    To-day we spend in ease, to-morrow die.

Why should we work when Nature's heart is still?
Why should we strive when Nature bids us rest?
We let her influence sweet our being fill,
Hushed as a child upon the mother's breast.

—*From Good Company.*

EDITORIAL NOTES.

THE public meetings of the Winter session of the Kansas City Academy of Science will commence on the evening of the last Tuesday of this month, at which time an address will be delivered by Ermine Case, Jr., Esq., upon the subject of "The South Kensington Museum." As Mr. Case spent a great deal of his time, while in London, during 1880–1, examining this magnificent museum, his account of its treasures will doubtless be of unusual interest. Other exercises will follow, and hereafter during the winter, the meetings of the Academy will be held regularly each month.

THE *post mortem* examination of the body of President Garfield clearly demonstrates the following points: 1st, That the diagnosis of the course and final location of the bullet was erroneous. 2nd, That electricity cannot be relied upon as a means of detecting and indicating the presence of lead in the human body. 3rd, That a much more ready and direct method of finding the course of the ball would have been to make the incisions from the seat of injury, and trace it thence, than by means of the ordinary incisions over the chest and abdomen. 4th, That, notwithstanding the septic condition existing, the wound was not necessarily fatal except for the injury to the splenic artery, producing an aneurism of that vessel, the rupture of which was the immediate cause of death. 5th, That the course of the ball, passing as it did almost directly across the body behind and within less than an inch of the liver and stomach, perforating the spine between and within half an inch, respectively, of the spinal cord and the great blood vessels of the body, and finally lodging and becoming harmlessly encysted in the soft tissues beyond, was a most marvelous example of the workings of chance, and a complete exoneration of the attending physicians from any charge of lack of skill and knowledge, either medical or surgical.

MR. W. W. ALEXANDER, of this city, has recently purchased for his own use an astronomical telescope of the very best quality; manufactured by Messrs. Alvan Clark & Son, of Cambridgeport, Mass., whose reputation as manufacturing opticians is a good guaranty of its fine quality. It is an achromatic refractor with object-glass of 6.3 inches diameter, and 7 feet focus, brass tube rack and pinion adjustment for focalizing, with six astronomical eye-pieces for direct viewing; also diagonals for zenith observations, first surface prismatic eye-piece for observing the sun. The defining power of the object-glass is so perfect that it will separate double stars 0.6″ apart, the atmosphere being in a good condition; and show stars of the 13th magnitude. The cost when mounted will be about $1,500, and will be paid by Mr. Alexander alone. It will be mounted in the eastern part of the city, and used to search for comets, minor planets, sun spots, etc., to watch and study the physical constitution of all heavenly bodies. This is an acquisition creditable to our city, but especially so to Mr. Alexander, who is in moderate circumstances and almost entirely self taught.

THE annual meeting of the Kansas Academy of Science for 1881, will be held at Topeka November 9th, 10th and 11th. The business meeting will be held at 3 P. M. on Wednesday, November 9th, at the office of Dr. A. H. Thompson. On Wednesday and Thursday evenings, popular lectures may be expected. The regular meetings for reading and discussion of papers will be held as usual, in the Senate chamber. On Friday evening, November 11th, it is expected that a reception will be given. The Mudge monument is now completed, and it is expected that many members of the Academy, under whose auspices it has been erected, will join an excursion party to Manhattan on Saturday, November 12th, and take part in the ceremony of dedicating the monument.

MR. DAVID J. MILLER, corresponding secretary of the Historical Society of New Mexico, in a circular address issued recently, gives a condensed history of its organization and the objects, and closes with an appeal to those persons having any books, pamphlets, manuscripts, journals, old letters or anything else bearing upon the history of that region, ancient or modern, to send them to him for preservation and for use in future reports of the society.

AN invitation has been extended through Professor Sylvester to Professor A. Cayley, D. C L., LL, D., F. R. S., Sadlerian Professor of Pure Mathematics in the University of Cambridge, England, to visit Baltimore and take part in the mathematical instruction of the Johns Hopkins University during the ensuing academic year. Professor Cayley has accepted this invitation, subject to the approval of the authorities of his own university; and it is expected that he will arrive in this country before the 1st of January next, and take a regular part in the instruction of the Johns Hopkins University, from that time until the close of the session in June.

COL. N. S. GOSS, of Neosho Falls, who has probably the largest and best private ornithological collection in America, numbering over 700 birds, of 350 different species, has turned over his collection to the State of Kansas, and it will soon be placed in one of the wings of the state house at Topeka. Col. Goss intends to continue making collections, and will soon visit the Pacific coast and South America for this purpose.

MALARIAL fever has been showing itself epidemically, in various parts of New England, where it has been for many years unknown.

IT is claimed that even the climate of New Mexico is changing with the advent of railroads and telegraph wires, the rainfall for the last year having been unusually great, and that of this fall notably so.

DR. SCHLIEMAN, the eminent archæologist, has arrived at Constantinople. The German embassy has asked for a firman authorizing the continuance of his excavations at Hissarlik, the site of ancient Troy.

GENERAL DICESNOLA arrived in New York on the 12th of October, from Europe, where he has been arranging to exchange the 9,000 duplicates of his Cyprian collection of archæological specimens for some of the works of art in the principal museums of Vienna, Berlin, Munich and Paris In this effort he is reported to have been very successful.

CAPTAIN HOOPER of the artic steamer Corwin, being the first explorer who has actually reached Wrangel Land, raised the United States flag thereon, August 12th, 1881, and formally named it New Columbia.

A SOUTH AMERICAN Industrial Exposition is soon to be held at Buenos Ayres, to which the United States is invited to send machinery, blooded stock, etc.

MR. CHAS. H. STERNBERG, of Ellsworth, Kansas, who has contributed several articles on the fossils of the west to the REVIEW, is now at the Museum of Comparative Zoölogy, at Harvard University, mending and cleaning his summer's collections.

A NEW departure has recently taken place in iron founding in this country. This is the reproduction of various art works in iron castings. Shields ornamented with repousse work, helmets ornamented in relief, medallions, plaques and Japanese bronze trays have been used as patterns and successfully copied, as well as many other objects of art, ancient and modern.

PROF. JAMES A. WICKERSHAM, of Lawrence, Kansas, has written a play entitled *Aliso & Acne*, which has been published in handsome style by Brentano's Literary Emporium, New York. A poetical friend promises to review it for us next month. In the meantime Prof. Wickersham has our best wishes for its success on the stage, where he expects to place it very soon.

PROF. A. H. THOMPSON, of Topeka, who has charge of the Dental department of the Kansas City Medical College, has commenced his winter course of lectures.

ITEMS FROM PERIODICALS.

THE publishers of *Good Company*, which is one of the best family periodicals in the country, in commencing a new volume, announce as an inducement for new subscribers that they will, for $3.75 sent to their office at Springfield, Mass., furnish the back numbers of the year just closed as well as the whole volume just commenced. $3.00 is the regular yearly subscription, so that for 75 cents the subscriber receives nearly 1,000 pages of first class miscellaneous literature. A "rare chance" indeed.

MALARIA: How caused and How prevented, will be a new book by Dr. Joseph F. Edwards, whose works on Bright's Disease, Constipation and Dispepsia have attracted such marked attention from general readers, the medical profession and the press. It is nearly ready, and will be published by Presley Blakiston, Philadelphia. In style and size it will be similar to the previous volumes, and its peculiarity is that the author takes a totally new view of troubles dependent upon malaria, and explains fully how general is the misunderstanding of this important subject.

THE Wisconsin Historical Society has 94,000 volumes and pamphlets in its library. It also has nearly 4,000 bound newspaper files in which the 17th and 18th centuries are better represented, it is believed, than in any other library in the United States.

THE Kansas City Review of Science and Industry, for October, has its usual fine complement of articles, original and selected. These embrace geology, anthopology, chemistry, meteorology, medicine, hygiene, etc., etc. The editor is making this the best magazine in the west, and we are glad to learn that is meeting with deserved success.—*Clinton Herald.*

THE first number of the second volume of the *Humboldt Library* series is Rawlinson's Origin of Nations, and is a good beginning of a new year; since it not only presents one of the most valuable works of modern authorship, but also presents itself in a new and convenient form for the reader. The quarto size has been dropped and the octavo adopted, a change which will be appreciated by all readers of the series, especially if they attempt to preserve the number, as they necessarily will, by binding it in annual or semi-annual volumes. Of the work itself it is not necessary to say anything. The name of the author and the title of the book are sufficient to make it sell largely at the price, 15 cents, to hundreds who could not afford it at the ordinary cost.

THE *Industrial Publication Company*, of New York, is putting forth a series entitled "Work Manuals," and intended for practical mechanics and artisans. Number II of the series is the work of Fred T. Hodgson, who has called it the Mechanic's Slide Rule and How to Use it. It is a compilation of explanations, rules and instructions suitable for mechanics and others interested in the industrial arts, and will be found a very useful aid in the workshop. Price 25 cents.

KANSAS CITY

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SCIENCE, MECHANIC ARTS AND LITERATURE.

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PROCEEDINGS OF SOCIETIES.

FOURTEENTH ANNUAL MEETING OF THE KANSAS ACADEMY OF SCIENCES.

TOPEKA, KANSAS, NOVEMBER 9TH, 10TH AND 11TH, 1881.

The business meeting was held at the office of Dr. A. H. Thompson, at 3:00 o'clock P. M., November 9th. After a little routine business the meeting adjourned until 7:30 o'clock P. M.

The Academy assembled at 7:30 o'clock in the Senate Chamber, and was called to order by the president, Prof. J. T. Lovewell, of Washburn College. The speaker for the evening, Prof. E. N. Plank, was introduced. His topic was "Botany Popularly Considered." The vast coal beds, the speaker stated, were the remains of primeval vegetation. Plants and trees have in all ages been regarded with remarkable superstition and reverence. Trees speak and teach many lessons. Men are now living who believe that a forked switch of hazel can determine the current of water many feet beneath the earth's surface. There are men who, like the swine, enjoy things which are pleasant to the taste and sight without learning anything of their nature, or even their names. Some acquaintance with nature may be gained by all to their profit. The vegetable kingdom is the great food-providing agency of the world. It may be somewhat difficult to give a set of definitions that would distinguish the plant from the animal kingdom, but this is owing to the minuteness into which both kingdoms descend. The movements of plants, such as twining and the leaves following the course of the sun, is power which must be in the plants themselves. The leaf of the Venus

Fly-trap closes so rapidly on its victim as to almost invariably secure it; then opens in readiness for another unwary insect. Evolution at present is only a thing, and whether a sufficient number of parts can ever be accumulated to prove it, remains to be seen. The vegetable kingdom by its growth, purifies the atmosphere and renders animal life impossible. Animals can live only on the organized matter which plants produce. Carbon, which in some of its forms is coal, diamond, etc., is the chief element of vegetable construction. Plants elaborate all the food from the mineral kingdom upon which men subsist, and therefore it is literally true that "all flesh is grass." The study of botany or any branch of natural science is an excellent system of training for the mind. The science of botany presents an ample field for research, and the period of a man's life is far too short to go over all. Science has failed to explain why one extremity of the young plant grows from the light and contrary to the laws of gravitation, while the other shoots upward in the air. It has also failed to explain why sap flows and rises in the trees; also why the same soil can produce plants of such diversified natures as the night shade, rose, etc.

At the conclusion of the lecture Prof. Lovewell announced the lecture for the following night, and the Academy adjourned to meet at the same place at 9:oc o'clock A. M. Thursday.

The programme of Thursday opened with a paper from Prof. Carruth or "Genesis and Geology." He fails to reconcile the records of the Mosaic anc geological history of the creation, and finds differences that he thinks will be se aside by a fuller knowledge on the subject.

The second paper was by Joseph Savage, on the "Agate Beds of Treg County." The agate beds of Trego county, Kansas, were compared with th chalk nodules in English strata, and much difference found in the character o their values or concretions and he thinks they were from different causes. Th matrix contains no fine lime, but is composed of silicate of alumina. Some of th agates are on the carnelian type, others opalized. The principal agate bed i Trego county is found near Collier Station, and in a square of about two rods Other inferior beds are found in the counties north and east of there. The agate are generally associated with jasper. This jasper shows the approach to the agat form in dendritic impression. The paper was illustrated with a great many spec imens that Prof. Savage had secured.

"Preliminary Stages of a Leaf-eating Lady-bird," by Prof. Popenoe, c Manhattan, followed. The professor stated that while he was spending a fe days in collecting in Colorado, he happened at Trinidad during the early part c August, and in collecting near that town found a species of *Epilachna* that h then thought to be new. It attracted his attention by its abundance and by i habits, which, like those of our northern lady-bird, *Epilachna borealis*, so strong separate this genus from the allied genera of lady-birds. The northern lady-bir in question, as is well known to entomologists and horticulturists, is the on common lady-bird whose habits are strictly herbivorous, the other species of th considerable and widely distributed family being accounted in all stages acti

allies to the gardener and fruit-grower from their aphidephagous propensities. The northern lady-bird was known to Fitch, Walsh and other of our older entomologists as being in its larval stages at least an enemy to plants of the cucurbitaceous family, feeding upon squashes and allied plants, often causing considerable loss in the product.

The species concerning which he now spoke is quite evidently an *Epilachna*. Its leaf-eating habits and its appearance point unmistakably to its close relationship to our northern lady-bird. From this it differs, however, in being more woolly, darker bronzed yellow and in having smaller black spots. Less obvious differences exist, but these will not here be particularized.

He gathered from the descriptions of the northern lady-bird, current in entomological literature, that our species resembles this also closely in its larval and pupal forms, it being a prickly, yellowish, humpbacked larva, rather sluggish in movements, like other lady-bird larvæ, and unlike most of them, living upon the tender parenchymatous portion of the leaves of plants. Our Colorado larva feeds upon the bush bean. The specimens were gathered in a garden where they were feeding on beans in great numbers. The larvæ were found principally on the under side of the leaves, and devouring the green portions, they left the woody net-work nearly clean. The pupa is attached to the leaf by the caudal portion with the larval skin in a roll about the tip of the abdomen. The perfect insects were gathered from the leaves where the larvæ were found feeding, and the only stage in which the beetle was found abundantly was the egg stage.

"Ancient Stone Remains on Summit of Rocky Mountains," a paper by J. R. Mead, of Wichita, was read next. It was as follows:

During the past summer I had occasion to travel over and along the continental divide, which separates the waters of the two oceans, as well as the counties of Gunnison and Chaffee, Colorado, and at a point about four miles west from the town of Monarch, near the head of the South Arkansas, I noticed the debris of very ancient works of stone which, considering their location, were very curious and interesting. They comprised a series of low stone walls, and extending along the smooth summit or backbone of the mountain and connecting two elevated rocky points, about a quarter of a mile apart. On the top of these points were circular enclosures of stone, ten or fifteen feet in diameter, and two feet in height; the walls were made by placing upon edge and leaning together slabs of granite rock, and were originally about two feet or more high and are so ancient that in many places the granite rock of which they were composed had disintegrated, and crumbled into sand. The course of these walls was generally north and south with frequent dips, spurs and angles, side walls and pens, forming an intricate system. The design of it was difficult to comprehend. These marks extended across a convenient top in the mountains, at an altitude of about 11,000 feet, and above timber line. They could hardly have been intended for defence, as the mountain range could be crossed as easily for several miles south as at this point, and I could not see that they would be of advantage in the capture of game. I have heard of such walls on the summit of the mountains further

north, from several parties; these are the only ones which I observed in my travels. Their origin and purpose may ever remain a mystery. I have implements of stone picked up in that locality.

"Three New Medicinal Herbs Indigenous in Kansas," a paper by W. S. Newlon, of Oswego, was read by the Secretary, Prof. Popenoe, the author being absent. Mr. Newlon in his work among Kansas plants had found three herbs widely distributed in Southeastern Kansas that possessed valuable properties heretofore unknown and unused by the doctors. The botanical names of the herbs are *Helianthella tenuifolia*, *Elephantopus tomentosus* and *Sabbatia campestris*. These herbs are all of a tonic nature and have been thoroughly tested by their discoverer, who claims they are becoming rapidly known throughout the world.

A miscellaneous discussion followed, in which many present particpitated, and then the Academy adjourned to meet at 3 o'clock in the afternoon.

The Academy met at 3 o'clock, the afternoon train bringing in a large number of members and several visitors.

The first paper was by Joseph Savage on the "Leavenworth Coal Mines." He showed the order and thickness of the strata met in boring the shaft, and stated that the lower eight feet of the shaft was impregnated with gas and contained many fossils in the finest possible state of preservation.

"The Analysis of Drinking Water" was the title of a paper by Prof. G. H. Failyer, of Manhattan. The professor had found some very dirty water used for drinking purposes. The sources of contamination were ordinarily cess-pools, barn-yards or kitchen slops thrown near the well, and though the earth for a while might act as a filter it would in course of time become saturated with the impurities and cease to remove them from the water percolating. One instance was given where six persons were attacked with the typhoid fever who had used the water from a certain well, and no others in the neighborhood had the disease. The professor would not say positively that the sickness resulted from the water, but suspected that it did.

The next was a "Description of the Habits and Characteristics of the Mot Mots of Central America," by George F. Gaumer, recently returned from Yucatan, where he has lived for four years, collecting natural history specimens. These interesting birds, he stated, composed the family *Momotidal*, which is peculiar to tropical America, being distributed from Central Mexico to Brazil. They are peculiar in having the cutting edges of the bill serrated. Whence their common English name "sawbills." The central tail feathers are peculiarly deprived of the web for several inches below the tip, leaving a short round portion full webbed at the tip. They live in holes in the earth and lay from four to six fine white transparent eggs. These birds are about the size of bluejays and are brightly colored, forming handsome specimens. The paper was illustrated by sets of the specimens described, with their eggs.

"Visualized Numerals" was the title of a paper by Dr. A. H. Thompson, of Topeka. This is a mental habit, that characterizes many persons, of arranging numbers upon a diagram or picture in the mind so that they cannot think of the

number without thinking of the diagram with the number in a particular place. The diagrams assume a variety of shapes, sometimes symmetrical and sometimes grotesque. The author of the paper is afflicted with the habit of arranging numals in the mind upon a diagram of peculiar shape. The scientists, Dr. Thompson stated, who had investigated the matter found that it was possessed on the average by about one man in thirteen, and one woman in thirty. The paper was illustrated by diagrams.

At the conclusion of the reading each paper was discussed at length and much valuable information brought out in this way.

The Academy adjourned at 5 o'clock to meet at 7:30.

The evening was very disagreeable, but a fair audience appeared to listen to the lecture of Prof. G. E. Patrick, of the University of Kansas, Lawrence, concerning "Chemistry as Related to the Fine Arts." The lecture was well worth hearing. It was written in language that could be understood by the plain wayfaring man, and being delivered in a manner totally devoid of oratorical pretense, was therefore all the more interesting.

The speaker first alluded to the fact that chemistry has its science as well as its art: "why" as well as its "how," and then indicated briefly the manner in which he would consider it, *i. e.*, as a science. He stated that chemistry is a mere youth in years and, perhaps, in attainments, as compared with astronomy and kindred branches of learning, but that it is vigorous and progressive and while not completed has greatly benefitted the world, even in its crudity. Reference was then made to the noble labors of Liebig in connection with agriculture, and the progress of his studies among fertilizing agents was detailed in a graphic manner. The professor next next touched upon the history of soda; how at the end of the last century it was scarcely known, its sources of supply being limited, but finally, in 1789 how they were enlarged by LeBlanc, who discovered a method by which sodium carbonate could be produced from common salt. The iron industry was cited as affording a striking example of the benefits accruing to the world from scientific research. Before Bessemer discovered his process of making steel twenty days were occupied in doing what can now be done in that number of minutes, and while then but two-pound bars could be treated, now masses of six tons weight are converted into steel and steel bridges, and rails made possible.

The art of dyeing, although practiced, in one sense, from time immemorial, had been given a high rank because of the efforts of the patient searchers among the "$H_2 SO_4$"'s of the universe. Particularly, said the speaker, is this true as regards the production of aniline dyes from coal tar, and the adoption of that beautiful invention by which ultramarine is made from pine shavings. Artificial stone and cement were cited as examples of science creating useful substances and the recent conversion of base earth into sapphire and rubies by two eminent French chemists in 1879, as showing that things of beauty and joy forever were not lost sight of.

Professor Patrick closed by giving a glimpse of that portion of the subject suggested by his theme which he had not time touch upon, and predicting for chemistry a future even more wonderful than its past. The lecture was an apt and timely statement of the utilitarian side of science and as such deserves a much wider hearing than it was granted last evening.

On Friday morning, November 11th, the Academy met at the Senate Chamber. The officers for the ensuing year were selected as follows: President—J. T. Lovewell, of Topeka; Vice-Presidents—Joseph Savage and J. R. Carruth, of Lawrence; Secretary—L. A. Popenoe, of Manhattan; Treasurer—R. P. Brown, of Leavenworth.

The committee on the Mudge monument fund reports that enough money for the monument had been received, leaving a balance to be devoted to the improvement of the grounds of Manhattan where the monument is to stand. $600 was the amount raised.

Col. Wm. Tweeddale, of Topeka, then read a paper on "The Importance of Water as Affecting its use for Mechanical Purposes." The principles underlying the study of the subject were discussed. He considered the inorganic impurities as sulphates and carbonates, and spoke of their disadvantages in mechanical uses, and also mentioned a means of purifying alkali water.

"The Salt Wells of Wichita," by J. R. Mead, was next. He stated that a shaft at Wichita was started for coal but failed to reach it and found salt instead. The county of Sedgwick lies in the Permian or the upper carboniferous formations. The first fifty feet of the shaft passed through a gypsum bed, the following 200 through clay, slate and limestone containing fossils. The next stratum was saturated with oil, burning readily. The next stratum was strongly salt, and salt water was found just below this, which rose 150 feet in the shaft. The drill has gone to a depth of 1,100 feet, passing a strong vein of brine, free from impurities and containing as much salt as any in the State. They expect to reach coal at a depth of 2,500 feet, and in case of failure to find coal intend to manufacture salt on a large scale.

"Igneous Rocks, of Kansas," by Robert Hay, was read by the author. The principal object of the paper was to call attention to the metamorphic deposits in Woodson county, which he stated furnished all the evidence of metamorphic action. He had specimens of amethyst, beryl, quartz and mica, from the locality mentioned, as well as many specimens of various rocks in whose formation igneous action must have taken an important part. In the discussion following the reading of the paper Prof. Snow stated that the action of the heat and water might be considered sufficient to account for the phenomena described. In this conclusion Prof. Mudge, deceased, is said to have agreed. Prof. Snow thought heat could not act as an agent here. Thought a much more full study of the locality must be made before a final decision could be reached. Prof. Failyer agreed with Prof. Snow, forming his opinion from the study of the Cherokee and Joplin lead regions.

Geo. S. Chase's paper on a "Preliminary List of Kansas Invertebrate Fossils" was read by title, the author being absent. It will be published in the proceedings.

Prof. H. S. S. Smith, of the State University, read a paper on "The Constitution of the Sun."* He described the rotation of the sun, its superficial appearance under high power of the telescope and the appearance and modification of the sun's spots. The spectroscopic appearance shown in the examination of the sun's spots, prominences and corona were described. The last he stated to be of unknown extent, origin and composition. Among other things he stated that the radiant energy of the sun's heat equals 10,000 horse-power to each square foot of its surface. The theory of the writer of the essay was that the body of the sun was in a gaseous state.

Mr. S C. Mason, of Manhattan, presented a list of Riley county fossils, and stated that rocks of the county belong to the Permocarboniferous and furnish a great variety of fossils. The list names fifty-seven species belonging to several classes, and gave distribution and other interesting data.

The Academy then adjourned to meet at 2 o'clock.

The first production of the afternoon was "A Visit to the Mammoth Cave," by Prof. Lovewell. The essay was a very interesting description of a trip through that cave, made by the Professor last summer.

Prof. F. H. Snow, of State University, described his archæological explorations in the Pecos Valley, New Mexico, where he, with several others encamped for one week last summer. They first began excavations on the site of the old Pecos church, but were stopped by the priests. They had dug a shaft about five and one-half feet down, however, and found a coffin and a few bones and a portion of clothing. A few feet below they found a fire-place and indications of fire of long standing. Still further down in the lower layer they found a skull and some pottery, and these relics and some stone implements that they found about the site they brought away with them. On a hill opposite the church they found specimens of pottery of the most ancient type, and also specimens of more recent origin. In one locality they found specimens of slag and indications of supposed mining shafts. The supposition was that these were evidences of mining by the ancient Pueblos.

Mrs. Joseph Savage recited an original poem that was very fine. It discussed the agreement of the two revelations of Genesis and geology, in a very happy manner. It was loudly applauded.

Prof. W. M. Crichton, of Topeka, read an essay on "The Physical Basis of Ghosts." The essay was presented in beautiful language and held that the physical basis of ghosts was in the mind of the person who saw them. The paper provoked an animated discussion on ghosts in general.

Prof. Plank, of Independence, Kansas, presented an interesting outline of the flora of Montgomery county, describing the species of plants found there. Many of them are peculiar to that locality and of great interest and beauty.

* This paper appears in the present number of the REVIEW.—ED.

Prof. Sadler, of the State Normal School, presented a short paper on "A Self-Registering Anemeter and Anemoscope."* He described an original electric contrivance for the registry on a paper ribbon of the force and direction of the wind. The appliance of this contrivance to the wind gauge will be a great benefit to meteorological instruments. Prof. Lovewell spoke on the same subject, saying that better modes than those of the present were necessary. He thought Prof. Sadler's appliance a very valuable one, as did Prof. Snow.

The next paper was by Prof. Snow on the natural history of specimens collected by the University Scientific Expedition. They had found a rattlesnake of a very rare kind—in fact the only perfect specimen known—and many lizards of equal rarity. The field of this collection was Socorro township and the mountains west. In five days collecting he had discovered ten new species, and two new genera of butterflies, and many other very rare species. A specimen of the most beautiful beetle known, *Plusiotus gloriosa*, was discovered. Frof. Snow further stated that the band of Indians that came near capturing their party was under the leadership of the same Indian—Nana—that attacked Dr. LeConte in 1851, in the same locality. The Doctor was also bug hunting. Prof. Snow then gave a very humorous and graphic account of the locality and the experience the party had with the Indians, fortunately all getting away alive.

Prof. Geo. M. Stearns, of Washburn College, then presented a brief paper on the desirability of the spelling reform, which led to considerable discussion. On motion the subject was made a special one for the next annual meeting of the Academy.

The following resolution was unanimously adopted:

Resolved, That the Kansas Academy of Science have heard with profound sorrow of the sudden death of Prof. L. A. Thomas, a member of this Academy, well known and honored through the State as an earnest student of science, and a successful teacher of youth. We can only bow in humility at this visitation of Divine Providence by which our beloved fellow-worker has been cut down in the midst of his usefulness and we extend our sympathy to his stricken family.

The Academy then adjourned to meet at the call of the executive committee. The next meeting will probably be held during the holidays of 1882.

In the evening the members of the Academy attended a reception given them by Dr. A. H. Thompson, at his residence, No. 31 West Tenth Avenue. The members all availed themselves of the occasion and enjoyed the evening in a social way very much. Occasionally scientific matters would be discussed *pro* and *con* with a zest and humor that did not destract from the pleasure of all present. Refreshments were bountifully served, and at a late hour the scientists separated, the majority leaving for their homes on the night trains.

* This paper appears in the present number of the REVIEW.—ED.

FIFTY YEARS' PROGRESS IN SCIENCE.

BY SIR JOHN LUBBOCK, PRESIDENT OF THE BRITISH ASSOCIATION.

(*Extracts.*)

* * * * * * * * *

Few branches of science have made more rapid progress in the last half-century than that which deals with the ancient condition of man. When our Association was founded it was generally considered that the human race suddenly appeared on the scene, about 6,000 years ago, after the disappearance of the extinct mammalia and when Europe, both as regards physical conditions and the other animals by which it was inhabited, was pretty much in the same condition as in the period covered by Greek and Roman history. Since then the persevering researches of Layard, Rawlinson, Botta and others have made known to us, not only the statues and palaces of the ancient Assyrian monarch, but even their libraries; the cuneiform characters have been deciphered, and we can not only see, but read in the British Museum, the actual contemporary records, on burnt clay cylinders, of the events recorded in the historical books of the Old Testament and in the pages of Herodotus. The researches in Egypt also seem to have satisfactorily established the fact that the pyramids themselves are at least 6,000 years old, while it is obvious that the Assyrian and Egyptian monarchies cannot suddenly have attained to the wealth and power, the state of social organization and progress in the arts, of which we have before us, preserved by the sand of the desert from the ravages of man, such wonderful proofs.

In Europe, the writings of the earliest historians and poets indicated that, before iron came into general use, there was a time when bronze was the ordinary material of weapons, axes, and other cutting implements, and though it seemed *à priori* improbable that a compound of copper and tin should have preceded the simple metal iron, nevertheless the researches of archæologists have shown that there really was in Europe a "Bronze Age," which at the dawn of history was just giving way to that of "Iron."

The contents of ancient graves, buried in many cases so that their owner might carry some at least of his wealth with him to the world of spirits, have proved very instructive. More especially the results obtained by Nilsson in Scandinavia, by Hoare and Borlase, Bateman and Greenwell, in our own country, and the contents of the rich cemetery at Hallstadt, left no room for doubt as to the existence of a Bronze Age; but we get a completer idea of the condition of Man at this period from the Swiss lake-villages, first made known to us by Keller, and subsequently studied by Morlot, Troyon, Desor, Rütimeyer, Heer and and other Swiss archæologists. Along the shallow edges of the Swiss lakes there flourished, once upon a time, many populous villages or towns, built on platforms supported by piles, exactly as many Malayan villages are now. Under these circumstances innumerable objects were one by one dropped into the water;

sometimes whole villages were burnt, and their contents submerged; and thus we have been able to recover, from the waters of oblivion in which they had rested for more than 2,000 years, not only the arms and tools of this ancient people, the bones of their animals, their pottery and ornaments, but the stuffs they wore, the grain they had stored up for future use, even fruits and cakes of bread.

But this bronze-using people were not the earliest occupants of Europe. The contents of ancient tombs give evidence of a time when metal was unknown. This also was confirmed by the evidence then unexpectedly received from the Swiss lakes. By the side of the bronze-age villages were others, not less extensive, in which, while implements of stone and bone were discovered literally by thousands, not a trace of metal was met with. The shell mounds or refuse-heaps accumulated by the ancient fishermen along the shores of Denmark, and carefully examined by Steenstrup, Worsaae, and other Danish naturalists, fully confirmed the existence of a "Stone Age."

We have still much to learn, I need hardly say, about this Stone Age people, but it is surprising how much has been made out. Evans truly observes, in his admirable work on "Ancient Stone Implements," "that so far as external appliances are concerned, they are almost as fully represented as would be those of any existing savage nation by the researches of a painstaking traveler." We have their axes, adzes, chisels, borers, scrapers, and various other tools, and we know how they made and how they used them; we have their personal ornaments and implements of war; we have their cooking utensils; we know what they ate and what they wore; lastly, we know their mode of sepulture and funeral customs. They hunted the deer and horse, the bison and urus, the bear and the wolf, but the reindeer had already retreated to the North.

No bones of the reindeer, no fragment of any of the extinct mammalia, have been found in any of the Swiss lake-villages or in any of the thousands of the tumuli which have been opened in our own country or in Central and Southern Europe. Yet the contents of caves and of river-gravels afford abundant evidence that there was a time when the mammoth and rhinoceros, the musk-ox and reindeer, the cave lion and hyena, the great bear and the gigantic Irish elk wandered in our woods and valleys, and the hippopotamus floated in our rivers; when England and France were united, and the Thames and the Rhine had a common estuary. This was long supposed to be before the advent of man. At length, however, the discoveries of Boucher de Perthes in the valley of the Somme, supported as they are by the researches of many continental naturalists, and in our own country of MacEnery and Godwin-Austen, Prestwich and Lyell, Vivian and Pengelly, Christy, Evans and many more, have proved that man formed a humble part of this strange assembly.

Nay, even at this early period there were at least two distinct races of men in Europe; one of them—as Boyd Dawkins has pointed out—closely resembling the modern Esquimaux in form, in his weapons and implements, probably in his clothing, as well as in so many of the animals with which he was associated.

At this stage Man appears to have been ignorant of pottery, to have had no nowledge of agriculture, no domestic animals, except perhaps the dog. His eapons were the axe, the spear, and the javelin; I do not believe he knew the se of the bow, though he was probably acquainted with the lance. He was, of ourse, ignorant of metal, and his stone implements, though skilfully formed, ere of quite different shapes from those of the second Stone-age, and were never round. This earlier Stone period, when man coëxisted with these extinct mamalia, is known as Palæolithic, or Early Stone Age, in opposition to the Neolith-, or Newer Stone Age.

The remains of the mammalia which coëxisted with man in prehistoric times ave been most carefully studied by Owen, Lartet, Rütimeyer, Falconer, Busk, oyd-Dawkins, and others. The presence of the mammoth, the reindeer, and specially of the musk-ox, indicates a severe, not to say an arctic, climate, the cistence of which, moreover, was proved by other considerations: while, on the ontrary, the hippopotamus requires considerable warmth. How then is this asociation to be explained?

While the climate of the globe is, no doubt, much affected by geographical onditions, the cold of the glacial period was, I believe, mainly due to the ecentricity of the earth's orbit combined with the obliquity of the ecliptic. The sult of the latter condition is a period of 21,000 years, during one-half of which ie northern hemisphere is warmer than the southern, while during the other),500 years the reverse is the case. At present we are in the former phase, id there is, we know, a vast accumulation of ice at the south pole. But when ie earth's orbit is nearly circular, as it is at present, the difference between the o hemispheres is not very great; on the contrary, as the eccentricity of the bit increases the contrast between them increases also. This eccentricity is ontinually oscillating between certain limits, which Croll and subsequently Stone ive calculated out for the last million years. At present the eccentricity is ·016 id the mean temperature of the coldest month in London is about 40°. Such is been the state of things for nearly 100,000 years; but before that there was period, beginning 300,000 years ago, when the eccentricity of the orbit varied om ·26 to ·57. The result of this would be greatly to increase the effect due to e obliquity of the orbit; at certain periods the climate would be much warmer an at present, while at others the number of days in winter would be twenty ore, and of summer twenty less than now, while the mean temperature of the ldest month would be lowered 20°. We thus get something like a date for the st glacial epoch, and we see that it was not simply a period of cold, but rather ie of extremes, each beat of the pendulum of temperature lasting for no less an 21,000 years. This explains the fact that, as Morlot showed in 1854, the acial deposits of Switzerland, and, as we now know, those of Scotland, are not single uniform layer, but a succession of strata, indicating very different condins. I agree also with Croll and Geikie in thinking that these considerations plain the apparent anomaly of the coëxistence in the same gravels of arctic and

ropical animals ; the former having lived in the cold, while the latter flourishec in the hot, periods.

It is, I think, now well established that man inhabited Europe during the milder periods of the glacial epoch. Some high authorities, indeed, consider that we have evidence of his presence in pre-glacial and even in Miocene times, but I confess that I am not satisfied on this point. Even the more recent period carries back the record of man's existence to a distance so great as altogether tc change our views of ancient history.

Nor is it only as regards the antiquity and material condition of man in pre historic times that great progress has been made. If time permitted, I shoulc have been glad to have dwelt on the origin and development of language, of cus tom, and of law. On all of these the comparison of the various lower races stil inhabiting as large a portion of the earth's surface, has thrown much light; whil even in the most cultivated nations we find survivals, curious fancies, and linger ing ideas; the fossil remains, as it were, of former customs and religions embed ded in our modern civilization, like the relics of extinct animals in the crust o the earth.

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Passing the Science of Geography, Mr. Clements Markham has recentl published an excellent summary of what has been accomplished during the hal century.

As regards the Arctic regions, in the year 1830 the coast line of Arcti America was only very partially known, the region between Barrow Strait an the continent, for instance, being quite unexplored, while the eastern sides o Greenland and Spitzbergen, and the coasts of Nova Zembla were almost un known. Now the whole coast of Arctic America has been delineated, the re markable archipelago to the north has been explored, and no less than seve northwest passages—none of them, however, of any practical value—have bee traced. The northeastern passage, on the other hand, so far at least as th mouths of the great Siberian rivers, may perhaps hereafter prove of commercia importance. In the Antarctic regions, Enderby and Graham Lands were di covered in 1831–2, Balleny Islands and Sabrina Land in 1839, while the fact o the existence of the great southern continent was established in 1841 by Sir Jame Ross, who penetrated in 1842 to 78° 11′, the southernmost point ever reache

In Asia, to quote from Mr. Markham, "our officers have mapped th whole of Persia and Afghanistan, surveyed Mesopotamia, and explored the Pam steppe. Japan, Borneo, Siam, the Malay peninsula, and the greater part o China have been brought more completely to our knowledge. Eastern Turk stan has been visited, and trained native explorers have penetrated to the r motest fountains of the Oxus, and the wild plateaus of Tibet. Over the norther half of the Asiatic Continent the Russians have displayed great activity. The have traversed the wild steppes and deserts of what on old atlases was called In dependent Tartary, have surveyed the courses of the Jaxartes, the Oxus and th Amur, and have navigated the Caspian and the Sea of Aral. They have pushe

their scientific investigations into the Pamir and Eastern Turkestan, until at last the British and Russian surveys have been connected."

Again, fifty years ago the vast Central Regions of Africa were almost a blank upon our best maps. The rudely drawn lakes and rivers in maps of a more ancient date had become discredited. They did not agree among themselves, the evidence upon which they were laid down could not be found, they were in many respects highly improbable, and they seemed inconsistent with what had then been ascertained concerning the Niger and the Blue and White Niles. At the date of which I speak, the Sahara had been crossed by English travelers from the shore of the Mediterranean, but the southern desert still formed a bar to travelers from the Cape, while the accounts of traders and others who alone had entered the country from the eastern and western coasts were considered to form an insufficient basis for a map.

Since that time the successful crossing of the Kalahari desert to Lake Ngami has been the prelude to an era of African discovery. Livingstone explored the basin of the Zambesi, and discovered vast lakes and waters which have proved to be those of the higher Congo. Burton and Speke opened the way from the west Coast, which Speke and Grant pursued into and down the Nile, and Stanley down the course of the middle and lower Congo; and the vast extension of Egyptian dominion has brought a huge slice of equatorial Africa within the limits of semi-civilization. The western side of Africa has been attacked at many points. Alexander and Galton were among the first to make known to us its western tropical regions immediately to the north of the Cape Colony; the Ogowé has been explored; the Congo promises to become a center of trade, and the navigable portions of the Niger, the Gambia, and the Senegal are familiarly known.

The progress of discovery in Australia has been as remarkable as that in Africa. The interior of this great continent was absolutely unknown to us fifty years ago, but is now crossed through its center by the electric telegraph, and no inconsiderable portion of it is turned into sheep-farms.

[*To be Continued*]

An eminent scientist says that all chemical actions may be regarded as actions either of contact or mixture, and are regulated in the former case by specific gravity and molecular weight—in a word, by the molecular volume of the bodies present, and in the second case by their molecular weight. In the general hypothesis of chemical action which he advances he rejects entirely the usually accepted notions of molecule and atom, and substitutes what are conveyed by the terms equivalent and atomic volume.

PHILOSOPHY.

THOUGHTS ON THE IDEALISM OF BERKELEY.

BY E. R. KNOWLES.

We can sympathize with what must have been the feelings of Bishop Berk ley when a contemporary of his, overtaking him one day, stole up behind him ar gave him a blow across the shoulders with a cane, and Berkeley, turning aroun asked, "What's the matter?" "There is no matter, Berkeley, you know," w the reply. We can realize how the philosopher must have chafed under the co sciousness that this man ridiculed his theory because he could not clearly unde stand it and appreciate its magnificence, and that in many cases his theory wou always be unjustly critizised because of the impossibility of its being made pe fectly clear to some minds.

For the convenience of my readers, let me briefly state here just what w Berkeley's theory of sense-perception. Berkeley carried Locke's ideas to the legitimate consequences. If the mind cannot perceive matter in any form; if t knowledge at which we can ultimately arrive is only a knowledge of a sensati or idea of the mind, what proof then, have we of the existence of matter? Wh proof that anything in the external world corresponds to these images of t mind? In fact, we must be quite indifferent as to whether matter really do exist or does not; for if it does, we cannot perceive it; if it does not, we are ju as well off as if it did. As a legitimate conclusion from these premises, Berkel says that it is impossible that the mind should know that the material world exis at all except that real objects, as we call them, are only combinations of idea existing only so far as they are perceived. "The only difference between the and the so-called imaginary ideas consists entirely in this: that the first are not d pendent on our will to produce them, but are always present to our mind whether we will or no. Imaginary ideas, on the other hand, come and go a cording as we will. Real ideas are also more lively and distinct, while those the imagination are faint and confused. The knowledge of spirit is striking contrasted with that which we have of matter. We know ourselves and our ow states or modifications directly. That the universe is permanent in its object viz.: ideas, and also in its laws, is to be explained by the fact that the etern spirit constantly sustains and presents these ideas for the contemplation of creat spirits. By means of these, the attributes and government of God are ma known. All the things that we perceive are the ideas of God."

Berkeley was one of the clearest headed philosophers that has ever live and the majority of those who have opposed his philosophy have not been ab

to grasp fully and appreciate the grand conceptions and hypotheses of that extraordinary intellect. This is shown by the insufficiency of many of the objections which have been made to his theory of sense-perception. Let us consider some of them. Does not the Berkelerian theory imply deception on the part of the deity? The very fact that our common sense tells us that we can only be certain of a sensation in the mind, apparently produced by a sensation of the bodily organism, and that we are able to know that our perception of an object may be a result produced by the Divine Will acting upon our minds, proves the contrary. As well charge the Deity with deception because the intuitive convictions of the ancients rendered it impossible for them to believe in the existence of the antipodes!

The Scottish school urge against the Idealists that the Ideal theory is contradictory to the intuitive convictions of the unperverted mind, and that Idealists are opponents of intuitive truth, whose actions betray that their intuitive convictions tell them differently from their theory.

The late Chauncy Wright, in one of his philosophical discussions, published in the *Nation*, once showed the weakness of the objection that the Ideal theory is contradictory to the intuitive convictions of the unperverted mind, by showing that the difficulty which even educated men among the ancients felt in conceiving the antipodes was not a difficulty of conceiving the rotundity of the earth, but a difficulty of conceiving men standing on the opposite side of the round earth, without having their feet stuck on, like flies to a ceiling; and this difficulty was such that these philosophere could not be made to credit its possibility; in other words, they had one of Dr. McCosh's intuitions on the matter."

He continues, "The antipodes were incredible to the ancients because they conceived the fact as a simple and unconditional one, and in contradiction of the the equally simple and unconditional fact of their own standing on the earth. And it is because we in modern times are able to resolve both facts into the conditions on which they depend, that they are seen not to be contradictory. So long as 'down' was conceived as an absolute direction in the universe, dependent on nothing but its own nature, so long were the antipodes incredible and stood in contradiction of as simple, original, and necessary a belief as 'that two straight lines cannot inclose a space.' In short, the ancients had in this case all the tests which the Scottish school apply as ultimate in the ascertainment of truth." The Idealist does not deny that there is an existence properly enough call the external world, and he questions not about the reality of this existence, but about the kind of reality it has. As Mr. Wright adds, "The existence of undisputed and indisputable facts is denied by no philosopher, and every true philosopher seeks for such facts; the 'idealists' and 'sensationalists' as well as the rest. But idealism was ever a stumbling block to the Scottish school, so much so that their intuitions seem to spring directly from an innate inability in the thinkers of that nation to understand this doctrine. They appear unable to

distinguish between questions concerning the origin of an idea and a doubt of its reality."

The holder of the inferential theory and the holder of the theory of natural realism agree that the first two steps necessary to a cognition of matter are, first, an impression on the bodily organism; secondly, a sensation in the mind. The third step is, according to the inferential or "sensation" school, an inference that there must be something outside of the mind exerting its influence upon it, and corresponding to the impression, according to the Natural Realist, thought.

The Natural Realist objects to the third step taught by the "sensation school," that it is "but an old error under a new form. It tells us nothing more nor less than that the mind contemplates a sensation instead of the material object. But a sensation is one thing, and a knowledge of the external world is another thing. From the fact that there is an unextended sensation in the mind, we can never infer that there is something extended outside of the mind, which creates this sensation. Furthermore, no connection whatever can be traced between a sensation and the object creating the sensation." The Natural Realist says that his view may seem to disagree with the idea of "immediate perception," but "every sensation is joined with an immediate perception or belief in the existence of the external object!" Does the Natural Realist prove to us anything more than that the mind contemplates a sensation instead of the external object? And if, from the fact that there is an unextended sensation in the mind, we can never infer that there is something extended, outside of the mind, which creates this sensation, we are no better warranted in implicitly believing, as does the Natural Realist, in the existence of an external object and then claiming that we have an immediate perception of the external object. If no connection can be traced between a sensation and the object creating the sensation, we certainly have little reason for inferring that a material external object exists, certainly much less for believing so. The thought that leads us to believe that the sensation in the mind, of which alone we are certain, is produced by an external object exerting an influence on the mind, may not be as correct or as mature, fo aught we know, as that which leads some one else to believe that *esse=percipi.*

When Dr. Witherspoon was President of Princeton College, the Berkeleriai philosophy had been adopted by most of the professors and students. The doc tor, however, was opposed to it, and once threw out this argument against it "Young gentlemen, if you think there is nothing but ideas in the world, just g out on the campus and butt your heads against the college walls; you will, at least get an idea of matter." This objection, that the intuitive convictions of the Ideal ist lead him to act inconsistently with his theory, does not hold good, for he mair tains that the universe is permanent in its ideas, and also in its laws,—that is, th Eternal Spirit constantly sustains and presents these ideas for the contemplatio of created spirits according to fixed laws. The Idealist, therefore, acts in perfe consistency with his theory. A student who would have been foolish enough t have followed Dr. Witherspoon's jocular direction would, in doing so, have acte regardless of those fixed laws, and in consequence, would have had some ver

unpleasant ideas presented to his mind for contemplation by the Eternal Spirit. So also the consideration of this doctrine, that "real ideas" are presented in accordance with permanent and fixed laws, will meet the following objections: One student in the senior class at Princeton, did not believe in the Berkelerian theory of matter. On one occasion, when the students were at supper, the dish being hot mush-and-milk, this youth uttered a loud cry of pain. The tutor who presided at the long table started up in alarm, as did the other students. "Mr. Tutor," exclaimed the young man, "I beg your pardon, but I've just swallowed an exceedingly hot idea."

A minister once consoled his clerical friend, who held the Berkelerian theory, and from whom a fine horse had just been stolen, by reminding him "that he had merely lost an idea."

Many objections made to the Berkelerian philosophy are worthless, because those who make them do not take into account that the ideal theory of matter does not apply to spirit.

GEOGRAPHY.

MARTIN BEHAIM'S GLOBE.

BY E. L. BERTHOUD, GOLDEN, COL.

Without doubt the discovery of America by Christopher Columbus was an achievement whose parallel has never been known anywhere, and whose results have been extraordinary, as well as immense in their influence on civilization and advancement.

Granting all this as self-evident, yet it is a plain fact that the existence of lands in the farther limits of the western ocean was known to some, had been visited, if we may trust the few accounts and fragments that we have left, by expeditions from Iceland, Norway and Greenland, besides the Irish and Welsh adventurers who claim they went to St. Brandon, and to Vinland or New England.

The obscure accounts which Columbus picked up in his northern navigations, besides the journey to Iceland, which he made, undoubtedly convinced him that beyond the Atlantic billows he would find new lands and the wealth of the Indies.

These ideas have been suggested to us upon an examination of Martin Behaim's Globe, or map, of the world, embracing the two Hemispheres and dating about 1490–91, just previous to the discovery of America, and Sebastian Cabot's Map of the World, which he made when Chief Pilot of Spain, early in the reign of Charles the Fifth, King of Spain.

Behaim's Map dates immediately before the discovery, and Cabot's Maj thirty or forty years after, the re-discovery of the New World.

Behaim was one of the most noted cosmographers of his age; he was a nativ of Nuremberg, in Germany, and in person took an active part in the advance ment of geographical knowledge; and we find him in the service of Portuga going with Diego Cam on a voyage of discovery along the west coast of Africa in the latter portion of the fifteenth century. Behaim's Map owes a good dea of its reputation to its representation of an island very near the Equatorial line which he names on his map of the Western Hemisphere, "*Insula Antilia*" *gen andt* "*Septevitade,*" and attaches this legend in German to it: "Nach Christ Geburth, 565, kahm S. Brandon mit seinen Schiffe, auf diese Insel der daselbs vil munders besahe und uber sieben Jahr darnach wieder in sein land zoge."*

This Island, very much in shape like the Island of Trinidad, extends abou to 7° north latitude, and thence south to about 1½° north latitude, not far, indeed from the position of Trinidad, and differing from it in longitude about 8°, whic need not be considered much of an error for that period of navigation, whe with most imperfect means of getting the average rate of motion of a ship unde sail, with nothing but stars to guide the pilot at night, and the sun by day, th daily reckoning was but one move beyond John Phœnix's rule, viz: "To find th distance to the nearest fixed star, guess at half the distance and multiply by two. Consequently, even for several centuries after Behaim's time longitudes were ca culated only by the daily count, by compass course and the "Log"; these, wit rough approximate observations for latitude and without the corrections for r fraction, parallax, curvature, etc. As late as the seventeenth century, nautic and astronomical tables contained directions for making astronomical quadran for direct sight.

St. Brandon, whoever he may be, or if we accept the report that he was a Irish saint who had left the far "Jerue" on a missionary trip, was evidently or who feared not to trust himself to the fickle ocean, in the small vessels of th perion.

That he visited and saw a large island in the western ocean, we are cor pelled to believe, for Behaim's own notes say that "seven years after, he returne to his own country." St. Brandon was a traveler evidently. Behaim's Glol has, for nearly 400 years, been the subject of much adverse criticism, not alwa just and sometimes grossly misinterpreted; yet to this day its quaintness and i average quality of accuracy have been admitted, and we cannot believe him seeking to anticipate or to deprive the great Columbus of his well earned fame.

Behaim believed that the earth was a globe, heretical even to this day, some esteem it; witness "Brudder Jasper" in Virginia, who honestly holds t for the old doctrine that the world is a vast plain, bounded, we suppose, by t "*Nimium propinqui solis*" of old Flaccus.

* Translation—About 565 after the birth of Christ, came St. Brandon with his ship to this Island, where saw many wonderful things and after seven years returned again to his own country.

Our venerable cosmographer, who with Diego Cam, explored the west coast to the Congo River, south of the Equator, could have easily verified, this fact witnessing nightly the diurnal rising and setting of the constellations and planets, with the new glories of the southern cross emerging from the South Polar Ocean.

Behaim's Globe dates about the year 1490. His African voyage dates 1483 and 1484, and he gave in this map the latest and most reliable delineation of the whole known world. The Cape of Good Hope is well shown with its Table mountains. The "Lunæ Montes," or Mountains of the Moon, yet shown in maps forty years ago as a veritable range of mountains in central Africa, appear on the Behaim Globe about 14° south latitude, and from them spring the river systems of south and central Africa. Lake Tschad is correctly given, while the Senegal and Gambia Rivers are shown in pretty accurate form.

Northern Europe is not very symmetrical, and Lapland is delineated as extending to the North Pole, with a group of islands west of it. Over the whole globe, Behaim indicates where some of the Apostles converted the heathen, while scattered over it are representations of towns, nations and their habitations. We find in the Eastern Hemisphere the Islands of Madagascar, Zanzibar, and Ceylon, with the Spice and Malacca Islands also, but far from their true positions, while the continent of Asia is delineated as extending south of the Tropic of Capricorn.

Cipangu (Japan) is many degree east of its true position, with a vast sea extending from that island to the North Pole.

China and Siberia are very badly shown, and north Siberia is in no manner shown as correctly as in the old Ptolemaic maps. It is laid down as extending to the North Pole also, which, with Lapland, made a circumpolar continent.

LATITUDE AND LONGITUDE OF KANSAS CITY.

BY E. A. HICKMAN, INDEPENDENCE, MO.

What is the exact position of Kansas City in latitude and longitude with reference to Washington City and the zero of North Latitude?

The rod on the tower of the Smithsonian Institution at Washington City, D. C., stands marked as being North Latitude 38° 53′ 16.64″, and West Longitude from Greenwich, England, 77° 01′ 16.18″.

Kansas City stands, as lately determined by a corps of United States scientists, on the 39th parallel of North Latitude; it passing a few hundred feet south of Independence Avenue, and at its juncture with the State Line it marks that point in the city 17° 35′ West Longitude from the point in Washington City. Thus we find that a point on the State Line seven and three-quarter miles south of the one here described in the city, is a point due west of the one first described in

Washington City, and west of the same 17° 35′, equal in to $946\frac{386}{1000}$ miles, and north of the equator 2,701 miles.

We therefore find that the scientific departments of the United States, through their various branches and highly perfected instruments, have defined the position of every desirable point on its boundaries, both sea-coast and internal, and also the latitude and longitude of every internal position.

From these external boundaries and internal positions, lines have been traced and measured so thoroughly that the area of each State, Territory and lake has been measured and its area definitely calculated and determined. The sum of these areas, exclusive of Alaska, the Indian Territory and the great lakes, is 3,709,196 square miles; equal to 56¾ States as large as the State of Missouri, and also equal to a square with sides 1,926 miles long, and would furnish a forty, acre tract of land to each of a population of 59,347,136 people.

Its most eastern longitude (west from Greenwich) is 67° West Longitud and its most western is 124½°, and extension westwardly, 57½° of Longitude and an extension of North Latitude from 25° to 49° or a northern extension o 24°, making in extreme north and south extension 1,648 miles, and in east an west extreme extension 2,851 miles. Within this vast area, God has given fo man's gathering all the blessings he can enjoy and he is called upon to gathe them by work.

Then deducting the Peninsula of Florida from the latitude—4°, Kansas Cit is found to be just midway between the north and south extremes, and deductin the New England States from the longitude Kansas City is in the center east an west.

EXPLORATION OF WRANGEL LAND BY RELIEF STEAMER RODGERS.

San Francisco, November 7th.

The steam whaler Belvidere has arrived; also, the whalers Northern Ligh Dawn and Rainbow. It appears the Dawn did not speak the Arctic relief stear er Rodgers as reported Saturday, but did speak the whaler Pacific, which ha communicated with the Rodgers. To-day we have direct news from the Rod ers. The Belvidere spoke her September 27th, near Herald Island, steami south for winter quarters, which she will make probably at St. Lawrence Ba The Belvidere brought the mails of the Rodgers, from which, and from convers tion between Capt. Owen, of the Belvidere, and Lieut. Berry, of the Rodger the following facts were learned: Lieut. Berry found Wrangel Land to be Island. He sent a party from the Rodgers out in small boats to explore the lan They returned to the Rodgers, having gone completely around it. The par also surveyed different parts of Wrangel Land. The Rodgers did not go roun lying up while the party in boats went out. The Rodgers, after having esta

lished Wrangel Land to be an island, steamed one hundred and twenty odd miles north and northwest in search of further land, but failed to find any Lieutenant Berry ascended a mountain on Wrangel Island, and from the top saw sea all around it. The season had been most favorable for exploration on account of its openness, notwithstanding stormy weather. Captain Owen said that from his observations he would not be at all surprised to hear of the Jeannette coming home by way of Greenland. The Rodgers intends to send out a sledge party from the winter quarters to explore the coast of Siberia. She expects to leave winter quarters next June, and go as far north as possible.

Lieutenant Berry, in a letter to the Secretary of the Navy, dated September 27th, writes that he crossed and recrossed the 178th meridian in 73° north, and with the horizon throughout and the sky to the north clear. He did not sight the land reported by the captain of the whaling bark, as situated in 178° west longitude and extending as far north of 73° north latitude as the eye could reach, and the Lieutenant adds: "I have found the north ice of such a nature that it would not be possible to pass its outer edge, consisting in places of heavy packs, and in others of unbroken fields miles in extent. I propose to proceed from here to the coast of Siberia and follow it to the westward, looking there for tidings of the missing Jeannette, and for a suitable harbor to winter in, and from which to send out sledge parties, and be in position to succor any one who may reach that coast. Failing to find a suitable harbor, I will have a party with dogs, sledges and provisions for one year to make a search, and will winter the vessel in St. Lawrence Bay, and send parties from there also. In the spring I will proceed to Plover Bay, fill up with coal and continue the search. Since writing, the land has proven to be an island of small extent, with no other land near it. I deem it unwise to winter there as recommended by the Jeannette relief board, under the false supposition that it extended far to the northward." While exploring Wrangel Island he found a cairn formed by Captain Hooper, of the United States steamer Corwin.

The *Stock Reporter* publishes extracts from a letter from an officer of the Arctic relief steamer Rodgers, dated October 16th at St. Lawrence Bay, where the ship arrived the day before. The sledge party was landed on the Siberian coast, about fifty miles from East Cape, with one year's provisions, with orders to sledge the coast to the east and west as soon as the ground was covered with snow. The Rodgers reached latitude 73° 44′ north. No land was visible to the northward, but to the southward the flight of ducks showed that there must be land in that direction.

ARCTIC PHENOMENA.

A remarkable echo was noticed between two mountains at Plover Bay; another, noticed by our sledge party in the cliff at Cape Onmann, Siberia, gives back more than a dozen echoes; and Baron Wrangel relates that a pistol fired near the

cliffs on the river Lena is echoed a hundred times. The great distance to which small sounds are sometimes transmitted is also worthy of record. The first time this acoustic clearness of the atmosphere came under observation was at St. Michael's, where a conversation carried on at an incredible distance could be distinctly heard. Amid the grim silence and desolation of Wrangel Land, at a time, too, when the air was acoustically opaque for this latitude, I distinctly heard our boatswain, a small man, with a squeaky voice, giving orders two miles, while laughter and sounds of the voice, when any one spoke above the ordinary tone, were heard with such amazing distinctness as to suggest telephonic communication.

THE JEANNETTE'S FATE.

By the schooner Golden Fleece, which arrived on Saturday from the Arctic, the brothers Krause, who passed through here some months since, the agents of the Bremen Geographical Society, have returned. The most open season in thirty years enabled them to make observations as far north as the neighborhood of Point Barrow, beyond the usual line of the ice fields. It is their belief from what they have experienced in the latitudes which they visited that if the Jeannette is not heard from this year, say within six weeks, she will never return. There are no settlements beyond the Siberian points where she was last heard from, and here the traces of the Rodgers cease also. Although in the Arctic Ocean, north of Behring Straits, the sea is so well open, along the Siberian coast it is ice-packed. Dr. Krause, the elder, has but little hope, therefore, that the Jeannette will ever again return, although it is just barely possible in his mind that she may.—*San Francisco Chronicle.*

OFFICIAL REPORT OF THE CORWIN'S CRUISE.

Interesting details of the Corwin's cruise in the Arctic are contained in a letter received Saturday at the Treasury Department from Capt. C. L. Hooper dated at San Francisco, October 22nd. It is in the form of a preliminary report and recounts the recent experiences of the cutter in the Arctic Ocean and Behrings Straits. Capt. Hooper says they sailed from St. Michael's July 9th, the date of his last report, and proceeded north, touching at Golowin Bay, Sledge Island, Kings Island, Cape Prince of Wales, Cape Espenberg and the head of Kotzebell Sound. They sighted the bark Northern Light, and learned that the whaling bark Daniel Webster was in the ice-pack to the northward. They made an attempt to get up the coast in shore of the pack to learn her fate, but found that impossible.

The top of Herald Island was searched for traces of the Jeannette and missing whalers. All prominent points were carefully examined for cairns, but non

vere found. They followed the edge of the pack to the westward and southward ioping to effect a landing on the south end of Wrangel Land. Finding it impossible to effect a landing until a decided change should take place in the condition of the ice, they crossed over to the Siberian coast, following the edge of the western pack. On the morning of August 5th, latitude 9° 50′ N., longitude 179° 25′ W., they picked up a lower yard about fifty feet long and twelve inches in diameter at the slings, possibly a part of the wreck boarded by the natives at Cape Wankarem. A part of the iron work still remained on the yard, quarter-blocks, ling-band, jackstay, etc. To the latter a piece of bolt-rope was attached, showng that the sail was bent when the yard was detached from the mast. The enire surface was so chafed and worn by contact with the ice that nothing remained o indicate its color, except under a piece of metal, where it had the appearance of having been painted black.

They made Cape Wankarem on the evening of the 5th, where they procured rom the natives the following articles taken from the wreck, supposed to be the Vigilant: One chain bodstay, with heart attached; several pieces of chain-plate, ne whole, with dead-eye strap attached; several small pieces of chain, iron bolts, ieces of iron bands, etc.; a sheath-knife bearing the initials "W. B."; a table ork, an iron spoon bearing the letter "H" on the handle, a small black leather ocketbook, containing a number of articles of cheap jewelry; a finger-ring with Iasonic emblems, two coins, 1 cent and 5 cents, a portion of a truss-pad and a Rodger's pocket-knife. Many of the articles were of no value for identifying the essel. Two whisky casks were also seen, marked Honolulu. The articles obained were placed on exhibition for identification at the office of Wright & rowne, ship chandlers, San Francisco, who fit out many of the whalers.

On the 8th of August they steamed to the northwest, following the coast line s far as Cape North, where they again came up to the ice-pack and hauled off iore, shaping a course for Wrangel Land. Two days later they landed, after a ard battle with the ice, and raising the American flag took possession of the couny in the name of the United States, giving it the name of New Columbia.

It is, he says, with some degree of diffidence that a new name is suggested r this hitherto unexplored and untouched land. It appears that Admiral Wrang-, after whom it had been called, not only never landed upon its shores, but ever approached near enough to the shore to obtain a glimpse of it. Kellett, hose name has been appended to the country by the English map-makers, only mly saw what he supposed to be an island, lying south of Herald Island. The ime of New Columbia is suggested as one of national character, and not calcuted to do injustice to any one, as the two prominent capes are named after ose eminent Arctic navigators, Wrangel and Kellett. They had good observaons during the day, and found their landing place to be in latitude 71° 40′ N., ngitude 177° 40′ W. They had confidently hoped to find some tidings of the annette at this point, either a cairn containing records or some sign of parties om the vessel having passed. When last seen by the whaler she was in the cinity of Herald Island, evidently trying to get near enough to effect a landing

there. This she did not succeed in doing, or at least she left no cairns or other marks by which her presence there could become known. They examined the shore-line with their glasses while approaching and leaving the land, north and south, and saw nothing but perpendicular cliffs of slate, from 100 to 300 feet high, the sloping banks of the river being the only place for miles where a party traveling over the ice would be able to effect a landing. Had a landing been made cairns would, of course, have been erected, and records of the cruise left. It seems equally certain that had the Jeannette landed either to the north or to the south, and remained any considerable time to explore, this place would have been visited, since it has natural advantages as a landing place over all other parts of the coast. As the first object of Capt. DeLong's voyage seemed to have been to land and explore Wrangel Land, it was to be presumed, Capt. Hooper concludes, that, had he succeeded in reaching it at all, he would have left an exploring party, even though he might not have gotten his vessel into winter quarters there. In view of these facts it is believed that the Jeannette did not reach the eastern part of Wrangel Land at all, and that if she reached any part of it she did not remain long enough to make any extended explorations. It seems equally clea that no accident befell the vessel while in the vicinity of Herald Island or Wrang el Land, both from the absence of any record of the event at those places, an from the fact that Capt. Hooper is reasonably certain from his own observations and the reports of the natives with whom he communicated, that her people hav not landed on any part of the coast of Siberia, between Cape Jakan and Eas Cape, or between Cape Prince of Wales and the Mackenzie River on the Amer ican side; nor had they passed along either coast in the vessel. The Corwin' party were unable to discover the slightest trace of her or her people, althoug during their two seasons in the Arctic they cruised a distance of about 15,00 miles and examined every accessible part of the sea thoroughly (including the ic pack as far as it was possible to penetrate), and over 1,000 miles of coast lin Therefore, taking into consideration the position of the Jeannette when last see the almost absolute certainty that she did not make an extended stay at Wrang Land or Herald Island, if she reached those places at all, and the reasonab supposition that she met with no accident, during the first winter at least, th necessitated the desertion of the vessel, it seems to Capt. Hooper strongly prob ble that she entered the pack northeast of Herald Island and was carried by it a northeasterly direction. This being the case, in view of the fact that not one the whaleships that have from time to time, in the history of this ocean, been ca ried north in the pack has drifted to the southward again, and knowing as they from the testimony of every Arctic navigator how futile would be any attempt resist the force of the pack when once fairly in motion, he may, he thinks, co clude that the Jeannette will not return by the way of Behring's Straits, but w continue to move toward the north and east; and although Capt. DeLong w undoubtedly take advantage of every lead in the endeavor to carry out his ori nal plan of making the east coast of Greenland or Melville Sound, his mo ments will be controlled almost entirely by the drift of the ice. Should he, the

fore, make the land to the east, it is by no means certain that it would be at either of the places named. In the event of the ship becoming hopelessly embayed, after drifting to the northeast after the first winter, and it became necessary to abandon her, they would doubtless make for the nearest land, which might be the continent between Cape Bathurst and Point Barrow, at Bank's Land, Melville Island, or Prince Patrick's Land. If on the continent they could communicate with the Signal Service party at Point Barrow, under the command of Lieut. Ray. If the distance were too great for them to travel, they could send word by the natives, who are constantly passing back and forth along the coast, hunting, trading or fishing. If they landed at either of the other places named, while they would be able to kill sufficient game to subsist, they would be unable to get away until a vessel was sent to their relief. The distance to the Hudson Bay trading post, or to any place occupied by white men, would be too great for men to travel equipped, as they would necessarily be if compelled to abandon their vessel and travel a great distance over the ice. If, therefore, no tidings of them are received through any of the search parties of the present year, Capt. Hooper suggests that a vessel be sent to Melville Island as early next year as the ice will permit, carrying three sledge parties, one for Bank's Land, one for the west coast of Melville Island and a third for Prince Patrick's Land. Whatever is to be done for their relief must be done promptly. If still alive, they are now entering upon their third winter of hardship in the Arctic regions; and if they have been compelled to abandon their vessel and are waiting for a vessel to be sent to their relief, unnecessary delay may, and in all probability will, prove fatal.

Capt. Hooper regretfully gives up all hope of the missing whalers Mount Wallaston and Vigilant.—*Washington* (D. C.) *Post.*

In a recent note W. T. Blanford described the distribution of land in the Indian Peninsula and the intervention of a vast plain traversed by the Indus, Ganges and Bramaputra. This plain has been generally considered to have been the basin of a great sea, but in the opinion of the author the evidence advanced does not appear to contain a single fact in favor of the sea having at any geological period occupied the Gangetic or eastern portion of the plain. The tract is evidently a depression area, filled up to above the level of the sea through a long period of time.

ARCHÆOLOGY.

DEAD CITIES OF NEW MEXICO.

COLUMBUS MOÏSE, LAS VEGAS, N. M.

To the east of the range known as the Manzano, which lies about the centre of the Territory, and runs parallel with the Rio Grande from north to south, is a region rich with relics and full of monuments for the antiquary and historian. Here even tradition is silent, and the ruins which still exist are the only witnesses. I speak of the remnants of the old cities of Abo, Cuerrò, and Gran Quivira. When they were founded, who their inhabitants, or how long their existence, is all matter for conjecture. The remains show their size, and the nature of their people, but further than this, through lack of thorough scientific investigation, we are left to wild guess-work or to nothing. Tradition speaks of seven great cities existing in times long past somewhere within the limits of New Mexico, known as the seven cities of the Cibola, but where they were is more than debatable.

Conjecture seems, too, to have been the only move toward a solution of a question which would doubtless prove interesting as instructive. The old site of what is known as the Pecos church, an oft described and venerable ruin is thought to have been one of these cities, but I think it rather unfounded because the timbers of this church, known to be over 200 years old, are still in perfect preservation, while those of the stone churches of Abo, Cuerrò, Gran Quivira and Belen, of which I shall speak, are, with the one exception of Abo, entirely gone, the vacant niches where they once rested, alone remaining in testimony.

The ruin of the church at Abo, has one little alcove about four feet square which yet retains the roof traces—four brown and rotten logs half dropped to pieces from decay. To me it seems that in these four ruins are found four of these storied cities, and I draw my conjecture from the similarity of architecture in these church ruins, of stone, still extant, as well as from the similarity of the subterranean dwellings about them. All four of these ruins show a knowledge of architecture and an evident acquaintance with the plumb and level, for the walls and lines are as correct as these instruments could make them. First, in order of importance, both in extent and mystery, is the site of the city of El Gran Quivira which lies, as I have said, beyond the ranges of the Manzano and Oscuros and in the valley between the latter range and that of the Gallinas. The proper dimensions of the main ruin, the church, I cannot give, for I did not take any measurements, but I should judge the extreme length to be about one hundred and fifty feet with an extreme width of probably fifty feet. The walls now standing would possibly measure forty-five feet in height, and vary in thickness from

five to ten feet. They are of dressed stone laid in mud, with angles, niches and secret recesses now disclosed to view by the masks having fallen. From the appearance of the apertures once windows, I should judge them to have been in pointed arches, for the tops are broken, fallen and irregular though the sides, and the sills of stone have suffered little.

By digging anywhere in the vicinity of the church one can enter the dwellings of the ancient inhabitants, as they were under ground, and resemble cellars more than anything else. In them are found many relics in the shape of stone and copper utensils, earthenware jars and vessels, and the usual debris. The most mysterious of all connected with this old city is regarding the water supply. The remains of cultivation are seen, huge acequias can be traced about the city; the old fields are easily told. But to-day there is not one drop of water visible, nor can any source be traced from which it could have come. Sands, such as exist in river beds and lakes, shine hot and dry about the town, and what might have once been a river bed divides the dead city, proper, from the church. There is one theory which might solve it, and that is, about this point ends what the geographers mark as the "Ancient Lake Basin," in the center of which are now three extinct volcanic craters and for miles about them the mighty flow of lava. Possibly this ancient city drew its water supply from this ancient lake and it might have been that a volcanic eruption ended at once lake and city; as the houses all bear evidence of a hasty abandonment; such things being still found in them which people at leisure would naturally have removed. There are other things attractive, and teaching their lesson; for the remains of furnaces and such rude means and vessels as the primitive races used in mining may yet be found scattered about in many places, showing conclusively the existence of mines which paid, even with their rude methods. All implements found are of either stone or copper; the furnaces of mud and rock.

The other towns I have mentioned, especially Abo and Cuerrò, have the same features as Gran Quivira, except the peculiarity of the lost water supply. The mortises in the church walls show that heavy timbers were used for roofing and they must evidently have been brought from a distance and men have carried them, for at that remote time horses and oxen were unknown, nor have we any remains of wagons, or wagon roads; they were probably carried on the shoulders of men in the way Indians still do, making numerical strength answer The churches of Abo, Belen and Cuerrò, however, differ in this, from that of Gran Quivira, these ones being built of small pieces of rough stone, laid in mud, while the latter is of large squares of wrought stone. All four walls of the Cuerrò church still stand, and it is the third in size; the Belen church being smallest of all, and in most ruinous condition, only a few piles remaining erect. Only one end of the building at Abo has fallen and that caused by excavations in search of treasure, for later day traditions tell, that some of the wealthy New Mexicans thus got their nucleus. Other and later searchers have found only corpses.

The remains of this Abo ruin are most picturesque as it stands on a knoll in the center of a rough valley with mountain and forest beyond and on every side

little hillocks indicating the hidden dwellings, while low stone houses and fences made of the very stone of the church surround it and are peopled by the men of to-day.

THE ART OF FOUNDING IN BRASS, COPPER AND BRONZE.*—CONCLUDED.

BY EDWARD TUCK.

The next great work of ancient times, of which we have any details, is the making of the various bronze and brass articles used in the building and fittings of Solomon's Temple, at Jerusalem, 1011 B. C., and this gives a really good and complete idea of the progress made in the art at that period of time.

After the formation of the Ark and its various fittings, the Hebrews were not called upon again publicly to exercise their skill in metal work. The forty years of desert wanderings rendered such quite unnecessary; and as all those that came up out of Egypt died in the wilderness, in all probability with their death passed away much, if not all, the skill and ingenuity then shown, except for weapons of war and possibly implements of agriculture. They (the Hebrews) for some centuries were so much engaged in taking possession of the land they were to inhabit in wars and fightings, that the ordinary arts of civilized life were not and could not be cultivated; notwithstanding the enormous wealth they had accumulated in the time of King David, yet when Solomon, his son, began to erect the Temple (which was a work their forefathers, when they left Egypt could have accomplished without assistance) there were none among the people who could do the skilled work necessary in casting and working the various metals. In consequence, Solomon has to negotiate with the King of Tyre to send him men and materials to do the work. "Send me, therefore, a man cunning to work in gold, in brass, and in iron," "and that can skill to grave with the cunning men with me whom David my father did provide" (referring to some skilled workmen who the same king had sent to King David at an earlier period).

Singularly enough, the man sent by the King of Tyre as chief of the workmen, was himself of Jewish descent on his mother's side, and had come of a family of metal workers, for we read, "his father was a man of Tyre, a worker in brass." This man directed the whole of this department of the work. The vastness of the quantity of bronze or brass used we are unable to determine, for we find (1 Kings viii 47) "Solomon left all the vessels unweighed, for they were so many, neither was the weight of brass found out."

It is impossible for any one to read the graphic account given of the Temple construction in the Book of Kings, especially of the productions in metal, and not be amazed at the great variety of the work done, and the beauty and finish with

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* A summary of the second prize essay of the Worshipful Company of Founders, 1880–81.

which it must have been executed, as well as the great quantities and immense castings, which would require the highest mechanical skill and knowledge.

The two bronze pillars which were fixed up in the porch of the Temple must have been splendid specimens of workmanship. Taking the cubit at the generally-recognized measurement, 21 inches, the pillars, inclusive of the capitals, will have measured over 40 feet in height and 7 feet in diameter, and the weight of the metal would be from 23 tons to 28 tons. Another question arises in connection with these pillars: if they were hollow, as Whiston in his translation of "Josephus" considers they were, it follows that the use of cores must have been known and practised at this time, although this invention is ascribed to Theodorus and Rhæcus of Samos at a much latter period; but this may be only another instance of the knowledge of certain kinds of manufacture being lost and rediscovered at some latter period.

In addition to these pillars, there was the Brazen or Bronze Altar, another gigantic work probably weighing about 200 tons; also the Molten Sea, an immense semi-circular vessel measuring seventeen and a half feet in diameter and eight and three-quarter feet deep, and containing 16,000 to 20,000 gallons of water, supported on a pedestal of twelve bronze oxen. We get no idea from the account of the size of these castings, but they must have been of sufficient size and strength to support the vessel, which, when filled with water, would weigh probably 100 tons.

In addition to these large articles, there were a large number of smaller ones, equally good in construction and workmanship; but a full description of these must be left to a further article. It is apparent that different qualities of bronze were used, for some of the articles are stated "to be of bright brass," evidently different mixtures of the alloy for the differing purposes. It is clear from the vast size of the castings that good mechanical contrivances must have been used to remove, fit up, and place them in position.

These works were cast "in the Plain of Jordan in the clay ground," or, as should be more correctly rendered, "in the depth of the clay ground between Succoth and Zarthan," showing them to have been molded in clay. Such large quantities of metal would require to be melted in a series of furnaces, in which the metal could be fused at one time, all tapped together, and the metal let run into the mold. A series of such furnaces would be constructed in a sort of a circle or square, under one large dome or roof, forming a chimney or tower.

It is most probable that such a method was adopted in those days, as we find from Nehemiah iii. 11: "Malchijah, the son of Harim, and Hashub, the son of Pahath-moab, repaired the other piece and the tower of the furnaces." This would refer to such a structure which, erected in the Plain of Jordan for the temple works, may have continued a sort of national foundry up to the time the Jews were carried captive into Babylon. And again, the restoration and consequent rebuilding of the Temple would require the same operations, and hence the repairing of the furnaces would be a necessary work.

The knowledge of the art of working in metals thus brought into Palestine by the Tyrians at the building of the Temple seems not to have afterward declined, for we find frequent references in Scripture to works of this kind. In 740 B. C. King Ahaz, visiting King Tiglath-pileser at Damascus, saw an altar which pleased him, and sending Urijah, the priest, a drawing of it, one was made for him exactly similar. In 596 B. C. Nebuchadnezzar, King of Babylon, broke up the bronze pillars, the sea, and the bases of the Temple at Jerusalem, and removed the pieces to Babylon (a work of considerable difficulty) and it follows that probably many of the bronze articles found by Sir H. Layard and others in the ruins of that city may have been made from the bronze of the Temple furniture.

A singular confirmation of the idea that the brass and copper of Scripture are bronze is given by Mr. Edwards in the *Edinburgh Philosophical Magazine*, 1850, where he describes certain relics found near Marazion or Marghazin, one of the oldest towns in Cornwall, leading to the conclusion that the Jews had smelting houses near the shore. The remnants of these smelting pits are still called by tradition Jews' Houses, and the town itself is also called Market Jew, in addition to Marghazin, which means Market Mount; called so, no doubt by the Jews, as the place where the metals were purchased and sold. Possibly the bronze alloy, the mixture of copper and tin, may have been cast here in ingots and shipped in that form; but this is conjecture.

The bronze of classical antiquity (Greek, *Chalkós;* Latin, *æs*) consisted o copper, with an alloy of one or more of the following metals—tin, lead, silver zinc; the quantity and character of the alloy changing with the changing time or different times or different purposes. Amongst existing bronzes, copper varie from 67 to 05 parts. The Phœnicians who traded with the Egyptians would als bring the tin alloy to the Greeks and Romans. Homer calls the metal Kassiteros and this is equivalent to the Arab word Kasdeer, by which tin is known in th East; it is also called Kastira in Sanscrit. We are enabled from the analysis c coins to arrive at some results as to the admixture of the metals. It thus appear from their coins that the Greeks adhered to a mixture of copper and tin till 40 B. C., after which they used lead. Silver is rare in these coins.

The Romans used lead in their coins, but gradually reduced the quantity till, under the Emperors Caligula, Nero, Vespasian and Domitian, they coine pure copper, but afterward reverted to the mixture of lead.

This work *Chalkós* originally appears to have been the word for pure coppe and is so employed by Homer, who calls *Eruthros* (red), *Aithops* (glittering *Phænnos* (shining), terms which will apply to pure copper or the bright alloys c bronze, such as the ancient mirrors were made of.

The old Greek poet describes the process of casting in almost similar term to those in which it would be poetically described to-day, showing us that th processes then used and now were as nearly as possible alike, and proves the a of working the various substances to have been well understood at that remot period.

The passage referred to is in the "Iliad" of Homer, in the description of the manufacture of the shield of Achilles by the god Vulcan:

Thus having said, the Father of the Fires
To the black labor of his forge retires.
Soon as he bade them blow, the bellows turned
Their own mouths; and where the furnace burned
Resounding breathed; at once the blast expires,
And twenty forges catch at once the fires,
Just as the god directs; now loud, now low,
They raise a tempest or they gently blow.
In hissing flames huge silver bars are rolled,
And stubborn brass, and tin, and solid gold.

Thus the broad shield complete, the artist crowned
With his last hand, and poured the ocean round;
In living silver seemed the waves to roll;
And beat the buckler's verge and bound the whole.

In this description of the casting, Homer uses the word *Chalkôs*, so that we can scarcely tell whether he means copper pure or alloyed. Further, it is more difficult when we read of the mythical Dactyles of Ida in Crete, or the Cyclops, being acquainted with the melting of *Chalkôs*. It is not, however, likely, that the later Greek writers, who knew bronze in its real sense, would have used the word *Chalkôs* without qualifications to describe objects which they had seen, unless they meant it to be taken as bronze.

Pausanias speaks of an old statue he had seen, made of separate pieces of metal fastened together with nails, and, using the same word, we understand him to mean bronze, as there exist very early figures of bronze thus made. We read also of the process called "sphyrelaton," being to hammer out the plates and fasten them together with nails. Pausanias also tells that "the Phœnicians pretended that Ulysses dedicated a statue of bronze to Neptune Hippius," but adds that "he does not give credit to the statement, as the art of fusing the metals and casting them in a mold was not then known." "In fact, the first who cast statues were Theodorus and Rhæcus, both natives of Samos."

It has been generally thought that their merit consisted in casting the statues with an inner core, which could be afterward removed, leaving the castings light, and therefore less costly. But this is open to question, as we have before seen from Assyrian bronzes having been found cast with an inner core of a date older than Theodorus and Rhæcus, and there is now in the British Museum an early Etruscan statuette from Sissa, on the Volturno, with a core of iron.

The Samians were very early noted for their skill in this branch of art, and before the foundation of Cyrene, B. C. 630, they made a bronze vase ornamented with griffins, supported on three colossal figures of bronze, for the Temple of Juno.

The art was known at a very remote period in Italy. Among the Etruscans bronze statues were common before the foundation of Rome, 750 B. C., and Romulus is said to have placed a statue of himself, crowned by Victory, in a four-horse car of bronze, in the new city. Pliny states that "King Numa Pompilius, the immediate successor of Romulus, founded a fraternity of brass founders and bronze workers."

By the Romans a compound was used under the name of "oncalchum" or "auncalchum," which appears to have possessed the composition and properties of brass.

A brazen bull is traditionally said to have been contrived by Pericles at Athens for Phalaris, Tyrant of Agrigentum, 570 B. C. It had an opening in the side, to admit the victims, and a fire was kindled underneath to roast them to death. The throat was so contrived as to make the groans of the victims resemble the roaring of a bull. The artist was made the first experiment, and the tyrant for whom it was made was roasted in it, 549 B. C.

The oldest seat of bronze founding to any extent was the island of Delos, and next to that the island of Ægina. Between these two there existed a rivalry in the times of Myron and Polycletus, of whom the former used the bronze of Delos, the latter that of Ægina. More celebrated than either was the bronze of Corinth, about which it is said "that when Lucius Mummius burnt Corinth, 146 B. C., all the metals in the city melted during the conflagration, and, running together, formed the valuable composition called Corinthian brass. This is exceedingly doubtful, but there may be spice of truth in it, as long before this period the Corinthian artists had obtained great credit for their method of combining copper with gold and silver. Pliny says of it: "It consisted of gold, silver and copper, and was considered more precious than silver, and little less valuable than gold.' There were three kinds of it, varying in color from white to dark yellow.

Corinthian brass appears, for the most part, to have been used for the manu facture of drinking cups and ornamental utensils. The Syriac translation of the Bible says: "Hiram made the vessels for Solomon's Temple of Corinthian brass." Pumps were invented by Ctesibus, of Alexandria, 224 B. C., and were wholly or partially of cast brass or bronze. The most distinguished colossal statue of ancient times was the Colossus of Rhodes, one of the seven wonders of the world. In the days of its prosperity the capital of the island of Rhodes was adorned with over 3,000 statues, but this one exceeded them all. It was erected at the port of Rhodes, in honor of the sun, by Chares of Lindus, a disciple of Lysippus, 290 B. C., or 288 B. C., out of the spoils which Demetrius left behind him when he raised the siege of the city.

It is asserted to have spanned the entrance to the harbor of the island, and to have admitted the passage of vessels in full sail between its wide-spread legs. Its height was about 105 feet, the time taken for its construction was twelve years and the cost amounted to 300 talents—about £70,000.

This stupendous work was thrown down by an earthquake about 224 B. C. and for nearly nine centuries lay in ruins on the ground. Pliny says: "It was

a wonder to behold. Few persons could embrace the thumbs, and the fingers were longer than the bodies of most statues. Through the fractures were seen large cavities, into which large stones had been placed to balance it whilst standing." After the fall of the Roman Empire, when the island of Rhodes was conquered by the general-in-chief of the Caliph Othman, he sold the metal lying on the ground, weighing about 720,900 pounds, to a Jew, who loaded 980 camels in transporting it to Alexandria.

A statue of Zeus, executed at Tarentum 326 B. C. by Lysippus (the master of the maker of the Colossus of Rhodes), was forty cubits high, and though it could be moved by a touch of the hand, yet resisted the force of storms by a support at the point of greatest stress.

On the number of bronze statues in these ancient times often depended the wealth of the State, cities such as Athens and Delphos having some thousands each.

Of the vast number made by the ancient sculptors nothing but a few fragments remain; but if the colossal head of Venus in the British Museum be taken as a typical example, it will show with what thinness and fineness the figures were cast. Or, again, as an instance of the quality of Greek bronze, the figure of Siris, also in the British Museum, on which a plate of bronze will be seen beaten out till it reaches the thinness of note paper.

But if the larger works fail, there is an abundance of statuettes, candelabra, mirrors, cestæ and vessels of all kinds, Greek, Roman and Etruscan.

Works in relief (*Nóreuma*), whether beaten out, chased, or cast, are comparatively rare, though this branch of the art was practiced by the greatest sculptors. The Temple of Athene Chalkoites in Sparta had its walls covered with bronze reliefs, but this was an exception to the general rule adopted in the temple decoration.

The greater number of mirrors that exist are Etruscan; a few may be Roman and Greek. But the general rule of their being Etruscan reminds us of the reputation the Etruscans had for the production of works in bronze—not perhaps of high art, but what may be more correctly termed, "industrial art."

They were also celebrated for modeling in clay, and this, according to Pliny, "was the stage of art which immediately preceded casting in bronze, and went hand in hand with it."

The mirrors give the finest examples of patina which we find; in the alloy there seems to have been mixed a considerable quantity of silver in order to obtain a highly reflecting surface.

For articles of furniture the Romans employed Greek artists and workmen. In bronze were made the sellæ, square seats carried about at Roman entertainments; also footstools.

In the excavations made at Pompeii and Herculaneum various works in bronzes are found, showing the general adaptation made of bronze by the Romans.

In the theater are bissellii, or chairs of state, made of bronze, and ornamented with silver, for persons of distinction and municipal authorities.

In the tepidarium of the baths are bronze benches, six feet by one foot, supported by four legs, terminating in the cloven hoofs of the cow, and ornamented at the upper end with heads of the same animal. In the same baths, a brazier of bronze, seven feet six inches by two feet six inches, supported on cast bronze legs, representing winged sphinxes, terminating in lions' paws. In one of the shops a bronze urn, evidently used for making warm decoctions, and similar to the muller now in use; a bronze mold for making pastry, and a pair of scales—articles of these kinds in addition to the large number of statues and ornamental articles.

In all the bronzes from Pompeii and Herculaneum, the blue color of the patina is very brilliant, although in other bronzes it is more generally some shade of green. This arises from their lying so long in the earth, a difference of soil probably makes a different patina; but something is also due to varieties in the alloy.

Greek seats (*thronoi*) are sculptured on the Parthenon frieze; and sumptuous Greek furniture during the last two centuries B. C. was made of bronze, damascened with gold and silver. It does not appear that the process of gilding bronze was carried to any extent in classical times, except in the production of finger rings, of which a considerable number remain.

During the excavations made in the Palace of Tiberius at Capri, the bronze cock of a reservoir was discovered. As there were conduits of water, and pipes necessarily conveying it to the baths, the knowledge of cock-making must have been known and practised, of which this discovery gives a practical proof.

By the time of the Byzantine Empire the power of modeling seems to have declined, and a taste for glittering appearance took its place, and hence the process of ornamenting bronze with reliefs was superseded by inlaying it with silver and other materials.

The art of bronze casting, which has thus sunk during the Byzantine period, was revived with great vigor in Germany in the eleventh century, and there used for the ornamentation of gates and doors of public buildings; notable instances being the bronze gates of the Cathedral of Hildesheim, A. D. 1015, and the column decorated with reliefs on the model of the Trajan Column at Rome, A. D. 1922.

In the twelfth century the art spread southward to Italy, and was at first taken up energetically in lower Italy. But though many interesting works of this date exist—and also from the thirteenth and fourteenth centuries—it was not until the fifteenth century that the art obtained its full mastery. Then the revival of classical art became a real revival under the Florentine artists. Andrea Pisano had made a bronze gate in the Gothic style for the Baptistry of St. John at Florence, 1330 A. D., and in 1401 A. D., the Florentine Council decided to erect another. A competition of artists for the work resulted in the selection of Lorenzo Ghiberti. The contract was entered into with him and his father, Novem-

ber 23, 1403, A. D., and the gates completed and fixed April 24, 1424 A. D. They are truly a magnificent piece of art workmanship, remarkable in several respects as specimens of figure and ornamental modeling of the greatest possible excellence, and which have formed the models in this style for artists of all the following years, and of metal casting which cannot be surpassed.

The subjects of the twenty-eight panels of the gates are from the life of Christ.

On January 2, 1424, A. D., Ghiberti received the commission for the second pair of gates for the same building, and these, containing subjects from the Old Testament, were completed and fixed June 16, 1452 A. D. The Martinengo Tomb, in Brescia, erected about the year 1530 A. D. to Marcantonio Martinengo, though by what artist is unknown, is a fine specimen of this period. The bas-reliefs of bronze are subjects from profane history, and a triumphant procession in bronze adorns the principal frieze.

This development of taste extended to Naples, Rome, Milan, and Venice. Even Raphael designed ornaments for the molders, of purest taste and most exquisite fancy.

In the sixteenth century it is found carried on with extraordinary skill in Germany at Nuremberg, Augsburg, Munich, and Coburg.

In France also we find the art gaining importance, as may be seen from the bas reliefs in the Chateau d'Anet, the residence of Diana of Poictiers, which was restored under Philibert de Lorme, 1547–8 A. D., and the monument erected to the memory of Charles VIII, 1499 A. D., around which were figures of the Virtues, executed in gilt bronze. Since then the art of sculpture in bronze may be said to have reverted to nearly its original limits, namely, the production of statues and groups in the round.

In 1699 a bronze equestrian statue of Louis XIV. was erected in the Place Vendome, Paris. This was of gigantic size, containing 60,000 pounds of bronze. It was demolished during one of the revolutions, 1792 A. D.

The wood furniture during the Renaissance period was decorated and inlaid with brass and bronze. In the eighteenth century we find Ciseleurs mentioned as makers of such brass edgings for furniture.

Perhaps the grandest bronze work of modern times is the colossal statue of Bavaria, completed and inaugurated at Munich, October 3, 1850. This statue was, at the suggestion of King Ludwig, designed by Schwanthaler, the sculptor, and his friend, Lazarini, who modeled the figure under his direction. For the casting it was necessary to melt twenty tons of bronze, a most perilous labor. To give some tangible idea of the size of the figure: In the head or upper part of the bust twenty-five men have found room, in the central part of the figure thirty-five to forty persons could dine, and the space of ground covered by the lower section is enormous in proportion. The figure of this colossal maiden, with the lion by her side, is fifty-four feet in height—nearly twice the height of the equestrian statue of Wellington, opposite Hyde Park corner—*Van Nostrand's Engineering Magazine.*

WERE ANCIENT COPPER IMPLEMENTS HAMMERED OR MOLDED INTO SHAPE?

BY PROFESSOR F. W. PUTNAM.

I notice in the last number of the REVIEW, page 406, that Prof. Reid states that a fragment of a copper axe which he found on the surface in Missouri, but which he calls "a Mound-builder's axe," was cast in a mold. Now, may I take the liberty of asking why he thought the axe was cast, and not hammered into shape? Several authors have made just such statements without giving their reasons, and to those who think that all the copper implements and ornaments found in the United States were hammered into shape and not cast in molds, such off-hand statements are very unsatisfactory, and in the present state of archæological science they ought not to be made without supporting evidence. If any one has a copper implement which he thinks was cast in a mold, do let us have his reasons.

On the same page Prof. Reid quotes Mr. Conant's statement that "Copper implements cast in molds, and the *molds* themselves have been found in Wisconsin." Now, can any one give an account of the "molds found in Wisconsin." What were they made of, and where are they now?

The difficulty of melting pure copper is considerable, and as we have pretty good evidence that at least a large proportion of the objects made of copper were hammered into shape, every statement of the melting and casting of copper by any people in North America, outside of Mexico, before European contact, must be taken with due caution. Even the statement by Champlain, that an Algonquin Indian gave him a piece of copper a foot long which had been melted into sheets and smoothed with stones, I question as the correct interpretation of the Indian's words. The "lumps of copper" could have been more easily pounded into sheets than melted by an Indian wandering into the copper region of Lake Superior, and the statement that it was smoothed with stones after melting, seems to me very likely to indicate the assumption, on the part of Champlain, of the melting part. That copper was used in large quantities by the Indians there is no doubt, and it was also used to a considerable degree by the tribes who erected the burial mounds in the Ohio valley and throughout the southwest, whoever they were, but I have not yet seen a single object made of copper from these sources that I should regard as having been cast; on the contrary, the evidence of hammering, and rolling between stones, is more or less clearly shown in all by the character of the surface and by the distinct lamination of the metal in places, when carefully examined with a lens.

Trusting that these remarks will call attention to a point on which contributors to the REVIEW, and other writers, should in future be more critical,

I remain yours very truly,

F. W. PUTNAM.

CAMBRIDGE, MASS., November 17, 1881.

NOTE.—We have also received a letter from a member of the Wisconsin Academy of Sciences living at Racine, informing us that Mr. Conant has, sometime since, admitted that he was mistaken in making the statement quoted by Prof. Reid relating to the finding of molds for copper implements in Wisconsin. —[EDITOR REVIEW.

GEOLOGY.

PLIOCENE FORMATION OF SOUTHERN OREGON.*—CONTINUED.

BY CHARLES H. STERNBERG.

I give below a list of the species discovered by myself during the fall of 1877. The specimens are in the possession of Prof. E. D. Cope, of Philadelphia, by whom they are described in the Bulletins of the U. S. Survey.

BIRDS.—Graculus macropus, sp. nov.
Cygnus paloregonus, sp. nov.
Podiceps occidentalis.
P. near culiformeus.
Podilymbus podiceps.
Anser Canadensis.
A. albifrons.
Fulica Americana.

MAMMALS.—Auchenia vitakeriana, sp. nov.
A. magna.
A. hesterna.
Equus major.
E. occidentalis.
Elephas primigenius.
Canis latrans.
Lutra, near pescinaira.
Castor fiber.
Thomonys talpoides.
T. clusius.
Mylodon sodalis, sp. nov.

* See REVIEW of February, 1881.

PROFESSOR SCHAEFFER ON THE BURLINGTON GRAVEL.

Since the publication of the article on the "Burlington Gravel Beds" in the October number of the REVIEW, the author has received the following note from Prof. C. A. Schaeffer, of Cornell University, New York, to whom was sent a package of chert for examination. Prof. Schaeffer has the chair of General Chemistry and Mineralogy, in Cornell University, and has a wide reputation as a chemist. He writes from Ithica under date of September 21, 1881, and says:

"Your letter of the 12th ult. was received during my absence from home, but until to-day I have had no time to examine the specimens. The pebbles consist of quartz, more or less regularly permeated by oxide of iron, and in some cases containing grains of sand. The distribution of the iron oxide is such in several cases as to characterize the specimens as jasper—namely, those having a waxy lustre. A closer examination shows in several cases a large number of small silicified corals, the two genera *Fenestella* and *Trematopora* being readily distinguishable. The species could only be determined by a more careful study than I can at present devote to the matter. For the same reason I cannot exactly decide the geological position in which these pebbles were found, somewhere in the Silurian, however. From a theoretical standpoint there is no doubt that the gravel will answer well as a *macadamizing* material, since the pebbles consist almost entirely of quartz."

This confirms the opinion of Dr. Eaton who, on a casual examination, thought the pebbles were jasper, as they possessed all the apparent characteristics, but reserved his opinion until he had made a chemical examination. While examining Shell Island, Prof. Parker found a fine bivalve fossil embedded in one of the pieces of gravel. The fossil was placed in the package of gravel sent for examination to Prof. J. D. Dana, of Yale College.

ZOOLOGY.

MUSEUM OF COMPARATIVE ZOÖLOGY, AT HARVARD COLLEGE.

BY CHARLES H. STERNBERG.

This Museum, founded by the lamented Louis Agassiz, teacher, and so ably carried on by his successor, Alexander Agassiz, who has built a large addition 80x120 feet and in other ways done much to carry out the wishes of his father, is situated near Harvard College, Cambridge, eight miles from Boston. The building is of brick, five stories high. It is 360 feet long and 80 feet wide, except the addition, which is 120 feet wide. The basement occupies the whole

under part of the building and is used for storing alcoholic specimens of Radiates, Fishes, Birds and Mammals, with rooms for aquarium and work shops.

First floor.—Palæontological exhibition rooms, with representative fossils from the Cambrian, Devonian, Silurian, Carboniferous, Triassic, Jurassic, Cretaceous and Tertiary formations. Also a zoölogical synoptic room, laboratories for college students, geological and palæontological work-rooms and professors, rooms.

Second floor.—Work-rooms in physiology and anatomy; synoptic room in palæontological formations; geological and palæontological room for special students, library, curator's room, etc.

Third floor.—Zoölogical exhibition rooms. Systematic collections of mollusca, polyps, fishes, birds and mammals. Also rooms for North American, South American, African, Indo-Asiatic, European and Siberian, Atlantic, Pacific and Southern Ocean Faunas.

Fourth floor.—Systematic collections of mollusca, polyps, erchinoderms, acalephs, sponges, crustacea, worms, batrachians and reptiles in four rooms. With rooms for North American, Madagascar, Australian and Indian Faunas. Laboratories for college students, and for special students in zoölogy.

Fifth floor.—Work-rooms for entomology, conchology, radiates, birds, mammals and skeletons, and large lecture room.

I think the plan to give a synoptic room, where orders and families can be studied, and that of arranging rooms in reference to the geographical distribution of animals, is not only original, but the best one possible. Associated with typical species of recent animals are their extinct ancestors in many cases, and it is greatly to be hoped that a large series of ancestral types will be exhibited here in the near future. The study of palæontology would then, as it should, go side by side with comparative anatomy. Skeletons of recent animals are usually mounted by the side of the stuffed ones.

The synoptic room includes typical specimens of the mammals, birds, reptiles, amphibians, radiates, class erchinoderms, articulates, classes cretaceans and insects, cephalopodes, mollusks, gastropods and lamellibranchiata.

In the zoölogical exhibition rooms, of the order Primates, man, orang, gorilla, lemurs, etc.

Order Carnivora—Several species.

Order Ungulata—American bison, skulls of Brazilian ox and Indian buffalo, cast of limbs and skull of the extinct Livatherium, skulls of Bos Primigenius, Rocky Mountain Goat and Sheep, Prong-horn, Saiga Antelope, Chamois, American Elk, Moose, Red Deer, Sambos Deer, Giraffe, Dromedary, Alpaca, Axis Deer, Zebra, skulls of Hippopotamus, Rhinoceros, Elephant and Mastodon.

Sub-order Primipeda—Northern Fur Seal, common Seal.

Order Cete—Pilot Whale, Dolphin, Manatee.

Order Brata—Giant Ant-Eater, three-toed Sloth.

Order Marsupialia—Tasmania Wolf, great Kangaroo, Ashy Coali, Vulpine Phalangu, etc.

South American Fauna—Ant-Eaters, Alpacas, Guanaco Llama, cast of the gigantic Sloth, Megatherium, Birds, etc.

North American Fauna—Birds, a large collection of all the classes found here; Mammals, Northern Hare, Wood Hare, Porcupine, Beaver, Yellow-bellied Marmot, Rocky Mountain Striped Squirrel, Grey, Red and Western Fox Squirrels, Woodchucks, Rocky Mountain Sheep and Goat, Virginia Deer, Mule Deer, American Elk, Woodland Caribou, Mexican Deer, American Bison, Mounted skeleton of Mastodon Panther, Canada Lynx, Bay Lynx, American Wild Cat, Grey Wolf, Arctic Grey, Red Kit and Prairie Foxes, Coyote, Black, Polar and Grizzly Bears, Fisher, Wolverine, American Sable, Weasel, Woold Ermine, Mink, Mexican Otter, Skunk, American Badger, Mexican Badger, American Otter, Raccoon, Civet Cat, Harbor Seal, Harp Seal, Sea Lion, etc.

One room contains representatives of Polyps in glass, colored like the original, they are very beautiful, with hues that rival our most brilliant flowers.

Taking this museum as a whole, I think it is one of the best places in Amerca for students in natural science. The large rooms in the Agassiz addition are not yet finished. Thousands of specimens are ready to be placed in them. Time would fail me to tell of the countless boxes, barrels, trays, jars, etc., that are filled with valuable specimens from all the domains of science, stored away for future exhibition, study or exchange.

I have only been a short time in the museum and my time has been occupied in unpacking, mending, and cleaning the collections I have made during the present season, among the rich fossiliferous beds of Kansas, so I have had little time to examine the museum collections. This I trust will excuse the imperfect manner in which I have written, but I hope I have said enough to give the reader a slight insight into the wonders from all parts of the world gathered here.

The public are admitted into the exhibition rooms from 9 A. M. to 5 P. M., and on Sundays from 1 to 5 P. M.

SOME LARGE MEMBERS OF THE WASP FAMILY.

BY REV. L. J. TEMPLIN.

While spending the last summer in Colorado I was permitted to see some of our largest wasps, that I had never seen before, and observed some of their habits that were of interest to me. I allude to the gigantic Digger Wasp (*Stizus grandis*, Say), and the Tarantula killer (*Pepsis formosa*, Say).

The former of these I observed in the act of capturing and carrying off a large specimen of Harvest Fly, (*Cicada canicularis*,) with which this species is accustomed to provision its nests. Their habit is to sting their prey just enough to paralyze but not to kill it. In this condition it is placed in a hole previously prepared, in which a single egg is laid and the hole is then carefully filled and smoothed over with such nicety as generally to elude the sharpest scrutiny of

rival females of the same species. For I am compelled, in order to tell the whole truth, that honesty is not a cardinal virtue of the Wasp family. If one of those females, in search of provisions for her future progeny, should discover a nest already provisioned, she would eagerly seize such stores as her own lawful prize. Hence they use great caution not to leave a trace of their work to mark the spot where their treasures lie buried.

While stopping in Pueblo, Colorado, during last August, I was one day standing under a tree just across the railroad from the Santa Fè Company's roundhouse, and a few rods west of the gas works, then in process of erection, when I suddenly heard, just over my head, a lively fluttering and drumming of a large *Cicada*. A moment later it fell to the ground only a few feet from the spot where I stood. On closer observation I discovered that it was in the clutches of a *Stizus*, and though employing its comparatively enormous strength, it was unable to shake off its enemy. No sooner had the wasp secured a firm hold on its prey with its second and third pairs of feet than it began to ascend the tree, partly by flying and partly by climbing with its first pair of feet. When it had ascended to the height of about ten feet it stopped and pierced its victim with its sting. In a minute or so the Cicada ceased all its struggles and became perfectly quiet. The Wasp now took a firm hold on it and started for its nest. Though its load must have weighed twice as much as itself the Wasp made a steady though slow flight, gradually rising till it passed over the roundhouse and disappeared from my sight.

A few weeks after the above occurence, while stopping at La Junta, Colorado, I was told that the Texas Tarantula was quite common in that vicinity. Several were caught while I was there, and I identified them as the real *Mygale Hentzii.* One man stated as a strange fact that he had seen a large Wasp pursue one of these large spiders into its hole and drag it out and carry it off. From his description I was satisfied that it was the *Pepsis* (*Pompilus*) *formosa*, Say, or Tarantula killer. Not one of thirty or forty men at work there seemed to be aware that the Tarantula had such an enemy. A day or two after that, while with some men at work removing some timbers, a Tarantula was killed. A few moments afterward a large wasp was seen flying around. I called attention to the fact that it was probably attracted by the odor of the Tarantula just killed. All watched with eager interest till, after circling around several times, it settled upon the the dead body of the Tarantula. After a very close scrutiny of that animal the Wasp left it and after soaring a few times around the spot it flew away. It seemed that its instinct taught it that an animal killed as that one had been would be subject to putrefaction and decay if placed in the nest with an egg, and thus bring death instead of life to its off-spring. This was a true Tarantula Killer that provisions its nest with this gigantic spider. It is said that this Wasp will pursue its prey with the precision and perseverance of a trail-hound; it will fly along a few inches from the surface of the ground, following up the trail along which the Tarantula has passed an hour or more before. When it sights its prey it begins to fly in circles around it, drawing nearer at each revolution till it makes

the fatal dart to seize its victim. As soon as the Arachnid finds itself discovered it stops, trembles and prepares for defence by rearing on its hind feet. The contest is short but sharp and ends in the spider's receiving a paralyzing thrust from the sting of its mortal foe, and it is soon put away, not exactly as canned meat, but as preserved food for use in a future time of need.

HUTCHINSON, KANASS, NOV. 12, 1881.

ASTRONOMY.

ASTRONOMICAL NOTES FOR DECEMBER, 1881.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.	Declination S.	Equation of Time.
1st.	16h. 32m.	21° 55′	10m. 34s. —
5th.	16 59	22 27	8 57 —
10th.	17 11	22 59	6 45 —
15th.	17 33	23 18	4 23 —
20th.	17 56	23 26	1 54 —
25th.	18 18	23 21	0 35 +
31st.	18 45	23 03	3 31 +

THE MOON.

Date.	Right Ascension.	Declination.	Apparent Semi-diameter.
1st.	1h. 26m.	13° 05′ N.	15′ 50″
5th.	5 05	22 05	15 15
10th.	9 16	10 40	14 47
15th.	13 02	11 03 S.	15 16
20th.	17 44	21 49	16 27
25th.	22 38	3 00	16 17
31st.	3 55	21 04 N.	15 20

The most favorable time for making telescopic observations will be from the 11th to the 15th and from 25th to the 29th.

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage.
1st.	15h. 17m.	16° 21′	10h. 35m. A. M.
5th.	15 39	18 10	10 37
10th.	16 10	20 18	10 53
15th.	16 41	22 06	11 05

20th.	17 14	23 30	11 18
25th.	17 48	24 25	11 33
31st.	18 29	24 47	11 51

Apparent diameter on the 1st 5.6″, on the 31st 4.6″. On the 4th 3h. A. M. t is 1° 23′ east of Venus.

VENUS.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage.
1st.	15h. 13m.	16° 38′	10h. 30m. A. M.
5th.	15 32	18 00	10 35
10th.	15 58	19 13	10 41
15th.	16 24	20 52	10 47
20th.	16 51	21 56	10 54
25th.	17 24	22 52	11 03
30th.	17 50	23 20	11 11

Apparent diameter on the 15th 10.4″, being about ⅙ of the apparent size hen nearest to the earth. The disk will be nearly round.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	7h. 03m.	25° 14′	2h. 17m. A. M.
5th.	6 58	25 31	1 57
10th.	6 53	25 53	1 31
15th.	6 45	26 14	1 04
20th.	6 36	26 33	0 36
25th.	6 28	26 49	0 07
31st.	6 18	27 02	11 33 P. M.

On the 26th it will be in opposition or 180° from the Sun, and in the best sition for observation. Apparent diameter on the 27th, 16.6″

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	3h. 06m.	16° 18′	10h. 21m. P. M.
5th.	3 05	16 11	10 04
10th.	3 03	16 03	9 42
15th.	3 01	15 57	9 21
20th.	2 59	15 52	9 00
25th.	2 58	15 48	8 39
31st.	2 57	15 45	8 14

Apparent diameter on the 15th, 44.9″, and is slowly decreasing during the tire month.

JUPITER'S SATELLITES.

Abbreviations used—In. denotes ingress; Eg., egress; Dis., disappearance; ., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the dow.

DATE.		PHENOMENA.	
2d,	6:57 p. m.	Ganymede,	Tr. In.
	8:28 p. m.	Ganymede,	Tr. Eg.
	8:51 p. m.	Ganymede,	Sh. In.
	10:41 p. m.	Ganymede,	Sh. Eg.
4th,	9:02 p. m.	Europa,	Sh. In.
	10:32 p. m.	Europa,	Tr. Eg.
6th,	6:26 p. m.	Europa,	Ec. Re.
	6:42 p. m.	Io,	Sh. In.
	8:18 p. m.	Io,	Tr. Eg.
	8:54 p. m.	Io,	Sh. Eg.
7th,	6:03 p. m.	Io,	Ec. Re.
9th,	10:16 p. m.	Ganymede,	Tr. In.
11th,	10:16 p. m.	Europa,	Tr. In.
12th,	10:36 p. m.	Io,	Oc. Dis.
13th,	7:51 p. m.	Io,	Tr. In.
	8:36 p. m.	Io,	Sh. In.
	9:01 p. m.	Europa,	Ec. Re.
	10:03 p. m.	Io,	Tr. Eg.
	10:48 p. m.	Io,	Sh. Eg.
14th,	7:59 p. m.	Io,	Ec. Re.
20th,	6:52 p. m.	Ganymede,	Ec. Dis.
	7:27 p. m.	Europa,	Oc. Dis.
	8:26 p. m.	Ganymede,	Ec. Re.
	9:38 p. m.	Io,	Tr. In.
	10:31 p. m.	Io,	Sh. In.
	11:37 p. m.	Europa,	Ec. Re.
	11:49 p. m.	Io,	Tr. Eg.
21st,	6:50 p. m.	Io,	Oc. Dis.
22d,	6:15 p. m.	Europa,	Sh. Eg.
	6:16 p. m.	Io,	Tr. Eg.
27th,	6:39 p. m.	Ganymede,	Oc. Dis.
	8:27 p. m.	Ganymede,	Oc. Re.
	9:38 p. m.	Europa,	Oc. Dis.
29th,	8:04 p. m.	Io,	Tr. Eg.
	8:54 p. m.	Europa,	Sh. Eg.
	9:07 p. m.	Io,	Sh. Eg.
30th,	6:19 p. m.	Io,	Ec. Re.

K. C. M. S. T. to be used in observatory.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 20m.	11° 18′	9h. 36m. P. M.
5th.	2 20	11 14	9 20
10th.	2 19	11 10	8 59
15th.	2 18	11 07	8 38
20th.	2 17	11 04	8 18
25th.	2 16	11 03	7 58
31st.	2 16	11 03	7 34

Apparent diameter on the 15th, 18.2″. Elements of the ring, outer Majo Axis 43.3″; Minor 13.4″; inclination of northern Semi-Minor Axis to circle o declination from North to East 16.8′; the elevation of the earth above the plan of the ring 18° 5′; the sun 19° 54′; earth's longitude from Saturn counted o plane of ring from the ring's ascending node on equator 87° 45′, on ecliptic 45°

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage
1st.	11h. 18m.	5° 19′	6h. 32m. A. M.
10th.	11 19	5 16	5 57
20th.	11 19	5 14	5 18
31st.	11 19	5 15	4 55

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 50m.	14° 27′	10h. 05m. P. M.
31st.	2 48	14 18	8 05

PHENOMENA.

On the 2d at 6h. P. M., conjunction of Saturn and the Moon. Saturn south 5° 36′.

On the 3rd at 7h. A. M., conjunction of Neptune and the Moon. Neptune south 4° 07′.

On the 3rd at 1h. 46m. P. M., conjunction of Jupiter and the Moon. Jupiter south 3° 04′.

On the 4th at 2h. A. M., conjunction of Mercury and Venus. Mercury east 1° 23′.

On the 7th at 7h. 32m. P. M., conjunction of Mars and the Moon. Mars north 5° 51′.

On the 8th at 4h. P. M., conjunction of Mercury and B'Scorpii. Mercury south 0° 05′.

On the 10th at 0h. P. M., conjunction of Venus and B'Scorpii. Venus south 0° 05′.

On the 19th at 7h. 47m. P. M., conjunction of Venus and the Moon. Venus north 0° 12′.

On the 20th at 5h. 16m. A. M., conjunction of Mercury and the Moon. Mercury south 1° 22′.

On the 26th at 11h. P. M., opposition Mars and the Sun.

On the 29th at 9h. 44m. P. M., conjunction of Saturn and the Moon. Saturn south 5° 32′.

On the 30th at 0h. P. M., conjunction of Neptune and the Moon. Neptune south 4° 6′.

On the 30th at 4h. P. M., conjunction of Jupiter and the Moon. Jupiter south 3° 6′

SOLAR THEORIES.

BY PROFESSOR H. S. S. SMITH, KANSAS UNIVERSITY.

Prof. Young's recent work* on the Sun has given prominence to some changes in the theory of the solar constitution, and it may be allowable to state what we know and what we do not know of this difficult problem.

Any sufficient theory of the constitution of the Sun must be one combining many considerations, astronomical, physical, and chemical. It is a problem difficult on account of its complexity, so many known and unknown quantities

* The Sun; by Prof. C. A. Young. Appleton, 1881.

entering that their due arrangement and subordination becomes a task well nigh impossible. Difficult also from the magnitude of the operations involved, pressures so great and temperatures so high that our terrestrial experiments are but gropings in the dark. We have to measure the sun by a candle.

The first point to be stated is that by far the greater part of the Sun is probably in a gaseous condition. That in the photosphere some substances are so far cooled as to become liquid and, may be, solid, there seems to be little doubt; but the central body, the chromosphere, part of the photosphere, and part of the corona are considered to be gaseous. It is generally believed that the gases composing the central part cannot act as do gases on earth; the density of the sun, the pressure consequent upon its great mass, and the temperature necessary to keep up the observed radiation, all producing results that modify the general properties of the gases. They "would be denser than water, and, since, as Maxwell and others have shown, the viscosity of a gas increases fast with rising temperature, it is probable that it would resist motion something like a mass of pitch or putty."† That the chromosphere and its prominences and some parts of the corona are in a gaseous condition, the spectroscope abundantly proves.

The supposition of the gaseous condition of the Sun enables us to explain some known facts. It is within reason to suppose that the pressure and temperature can be so combined as to produce the known density of the Sun. In fact, if we but knew that there is but one element in the Sun, and what that element is, we could calculate the temperature from the known density and pressure.

The source of the energy radiated by the Sun and the manner of its radiation are readily explained on this gaseous hypothesis. The light and heat may come from one or both of two sources, (1). gases and vapors so condensed as to give continuous spectra, (2) matter that has cooled below its boiling point and has consequently become liquid or solid. It will be seen that the latter is the more probable condition of affairs. The supply of energy is explained according to the well known fact of the heating of a gaseous sphere by the contraction caused by cooling. It is estimated that a reduction of the solar diameter 220 feet per annum would produce the present radiant energy. It is quite probable, however, that this contraction is not the only source of the Sun's heat, for the impact of meteors cannot fail to set free an immense amount of energy.

Again by admitting that the sun is gaseous rather than solid—the latter supposition was made by Herschel and is held by Zöllner and hinted at by Spoerer—the unequal times of rotation at different latitudes can be considered as possible; so far as I know, however, no adequate explanation of this phenomenon has yet been advanced.

To explain the phenomena seen at and near the visible surface of the sun it becomes necessary to localize certain actions that are supposed to take place in that region. Briefly it is supposed that the region which we call the photosphere is so cool in comparison with the central parts that its temperature is below the

† The Sun; page 286.

boiling point of some substance (probably of the carbon group) and that this substance is in a liquid or solid state, being cooled as masses of vapor rise from the interior. This cooling comes from both radiation and expansion. When sufficiently cool to appear dark in comparison with the hotter droplets, it forms a a cloudlike layer of smoke. It must be borne in mind that the bright droplets and darker smoke particles are floating in an atmosphere of the vapors of other metals; for the temperature is above the boiling point of all elements but the one supposed. The supply of liquid droplets is easily accounted for by supposing that the smoke particles are continually raining down through the region of cooling and, after being heated in the interior, are again forced upward, again liquified, and again become smoke. White light is given out by the drops of molten matter and, during its course through the incandescent vapors in which these drops float, is robbed of certain rays chosen by those vapors; while in passing through the smoky layer general absorption takes place. This conception, first fully elaborated by Prof. Hastings,* explains satisfactorily many known facts. The mottled appearance of the Sun's surface, the general absorption with its prominent increase near the limbs, the selective absorption and its very feeble modification at the limbs, faculæ, sun-spots, and some puzzling questions of solar spectroscopy, all yield readily to its influence. As an explanation of photospheric phenomena the theory seems to be quite satisfactory, but its province is limited.

The condition of affairs in the chromosphere, the formation and nature of the prominences, the velocities with which the matter that composes them is forced upward, the nature and condition of the atmosphere in which they are, their density and temperature, these are questions that have, as yet, no satisfactory answers.

And what of the corona? It has been conjectured that it consists of matter ejected from the Sun and kept in suspense by electrical repulsion; that there is a constant supply of this ejected matter; that there is an exceedingly attenuated atmosphere of gas surrounding the Sun and through it clouds of meteors follow their orbits obedient to the law of gravitation. The truth is that the only facts that we know are that it is partly gaseous and partly solid (or liquid) and that its density is very small indeed. Beyond these, conjecture has supreme control.

We may say, then, that in all probability the Sun, as a whole, is gaseous; that the photosphere is a region of liquefaction and solidification; that we know but little about the prominences; still less about the corona; and that our ignorance of solar dynamics is almost perfect.

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* American Journal of Science and Arts. Third Series, Vol. XXI, page 33.

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

Highest barometer during month, 29.40 on the 19th. Lowest barometer during month, 28.38 on the 17th.

Highest temperature during month, 72° on the 5th. Lowest temperature during month, 07° on the 19th.

Highest velocity of wind during month 39 on the 17th. Snow on the 18th.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Oct. 20th to 30th.	Nov. 1st to 10th.	Nov. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	42.8	34.5	21.5	32.9
Max	63.0	59.3	47.8	56.7
Min. and Max	53.6	46.8	34.0	44.8
Range	21.1	24.8	24.2	23.4
TRI-DAILY OBSERVATIONS.				
7 a. m.	49.0	40.7	33.6	41.1
2 p. m.	62.4	55.1	37.8	58.6
9 p. m.	52.0	41.8	33.3	42.4
Mean	54.2	45.8	34.8	44.9
RELATIVE HUMIDITY.				
7. a. m.	.88	.80	.82	.83
2 p. m.	.71	.57	.69	.66
9 p. m.	.75	.79	.70	.75
Mean	.81	.73	.74	.76
PRESSURE AS OBSERVED.				
7 a. m.	28.84	28.94	29 03	28.96
2 p. m.	28.80	28.90	28.94	28.88
9 p. m.	28.81	28.96	29.05	28.97
Mean	28.82	28.93	28.97	28.91
MILES PER HOUR OF WIND.				
7 a. m.	14.1	14 9	17.2	15.4
2 p. m.	20.4	24.1	23.6	22.7
9 p. m.	14.0	16.6	17.3	16.0
Total miles	3864	3984	4767	12613
CLOUDING BY TENTHS.				
7 a. m.	4.8	5.2	5.4	5.5
2 p. m.	6.4	6.1	5.1	5.9
9 p. m.	3.2	4.9	3.6	3.9
RAIN.				
Inches	.46	1.70	.00	2.16

ON AN ELECTRIC SELF-REGISTER FOR THE ANEMOSCOPE AND ANEMOMETER.*

BY PROF. H. E. SADLER, OF THE KANSAS STATE NORMAL SCHOOL.

The current from a Robinson's Anemometer is carried to four springs, electrically connected about the dial of the anemoscope, each of which presents a projection at one of the cardinal points. The arrow carries a section of a cylinder, concentric with its axis and three-eights of its circumference. which, coming in contact with either of the projections, forces its spring against a binding post. From each of these four posts an insulated wire returns to the battery through an electro-magnet.

The north and south magnets are placed on opposite sides of an armature carrying a pencil. A second pencil is controlled by the east and west magnets and rests by the side of the first on a cylinder carrying a tape and revolved by clock-work.

The pencils are held in place, when the circuit is broken, by springs on opposite sides, which are attached by threads to the armature and also to winding posts at each end of either spring. In this way the spring is prevented from pulling the armature past the center.

The velocity and direction of each mile is thus recorded to eight points of the compass.

THE WINDS THAT BRING OUR RAINS.

BY A. W. BROWNE, U. S. SIGNAL SERVICE OBSERVER, LEAVENWORTH, KAS.

As that ancient and time worn theory which claims that "the amount of rain that falls in Kansas is entirely dependent upon the snowfall in the mountains" is again brought before the public by its few supporters, the signal service will give below in the light of facts the result of ten years' systematic observations in the Missouri Valley.

The prevailing wind for each year, during the past nine years, has been south, as will be shown by the following table:

* A Paper read before the Kansas Academy of Sciences.

PREVAILING WIND FOR EACH MONTH IN THE YEAR.

	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881
January	NW	N	S	NW	S	S	N	S	S	N
February	S	NW	S	NW	S	N	N	S	S	NW
March	NW	S	N	NW	NW	S	NW	N	N	NW
April	S	N	N	NW	S	N	S	SE	S	N
May	S	S	S	S	S	S	S	S	S	SE
June	S	S	S	S	S	S	S	S	S	S
July	S	S	S	S	S	S	S	S	S	S
August	S	S	S	S	S	S	SW	S	S	S
September	S	S	S	S	S	S	S	S	S	S
October	S	S	S	S	S	N	S	S	S	S
November	NW	N	S	N	NW	NW	N	S	N	
December	N	N	S	S	NW	NW	N	S	N	

The above is determined from seven observations each day, and at the close of the month the number of times the wind was observed blowing from each direction is summed up, and the direction having the greatest sum is the prevailing wind for the month.

It will be seen that the prevailing wind for eight months of the year is south. This prevailing wind generally extends uninterruptedly from April to November, or during the season of the greatest rainfall. The prevailing wind during the winter months is from northwest to north. Notwithstanding that it has been asserted recently that the prevailing wind during spring and summer was southwest, there is only one instance during the past nine years where the prevailing wind for any month in the year was southwest, viz: August, 1878.

The following table gives the rain and dry winds for the Missouri Valley for each month in the year:

MONTH.	RAIN WINDS.	DRY WINDS.
*January	N E or N W	W or S
*February	N E or N W	W or S
*March	S or E	N W or S W
April	S or E	N W or S W
May	S W or S E	N W or S W
June	S W or S E	N W or S W
July	S or E	N N W or W S W
August	S or E	N W or S W
September	S or E	N W or S W
October.	S or E	N W or S W
*November	N E or N W	W or S
*December	N E or N W	W or S

* Or Snow during these Months.

These winds have been determined by taking each and every rain or snow storm that has occurred during the past ten years and noting the direction of the wind for three observations preceding; the direction during the storm and for three observations following it.

The table shows that the winds that bring our rain, eight months of the year, (from March to October) are southerly, while the dry winds are from northwest to southwest, the mean being west which is the location of the mountains from here. Invariably during the winter months, (the season of the smallest precipitation) northeast to northwest winds bring our rain and snow storms, whilst the dry winds are from west to south.

Furthermore, if the "Rocky Mountain rain theory" is correct and the greater portion of the snow is absorbed, why does not Western Kansas have more rain than the Eastern portion of the State, as it is in closer proximity to the mountains: also what causes the annual June rise in the Missouri River?

Much stress has been laid upon the fact of some old bridges being but ten feet over the beds of streams in the mountain slopes as an evidence that the melting snow mainly passes off with the air; this may be true in a few isolated cases, but we know that an immense volume of water goes down the Missouri River every summer, to the Gulf; one of the most remarkable instances of which is fresh in the memory of every one, viz; the great flood of last April. The cause of this rise is well known to have been the melting of the snow in the mountains. This vast amount of water according to natural laws must return by some source, which is evidently the atmosphere, otherwise this section would become an arid desert.

In conclusion, I will cite two cases of recent date to disprove the "snow theory." At the close of the winter of 1879–80 but little snow remained unmelted in the mountains, there being but four inches on the summit of Pike's Peak; still the rains during the following spring and summer (1880) were in general up

to the average, and notably during July and August excessive. The snowfall during the winter of 1880–81, as every one remembers, was the largest known for years, and the rainfall during the spring and summer just closed was about one-half the average; in consequence of which the ground was scorched and the grass and growing ctops completely burned up in many instances, which would not have been the case if the snowfall in the mountains governs the amount of rain that falls in Kansas.

WHAT IS AN INCH OF RAIN?

An inch of rain is that quantity which, falling upon a level surface and not absorbed or allowed to run off would stand one inch in depth. The amount of water falling on one acre of land when the rainfall is one inch, would astonish any one who has given no thought to the subject. On each square foot of surface there would be 144 cubic inches, and on one acre, which contains 43,600 square feet, would be 6,272,640 cubic inches, which, reduced to imperial gallons, each containing ten pounds avoirdupois, would be 22,623 gallons, or 226,230 pounds, something more than 113 tons weight to the acre. The average annual rainfall in this locality approximates 50 inches; consequently, each acre receives 5,655¾ tons weight of water in a year. This amount of water would require a train of 565 freight cars to carry it. If one had to water a 640 acre farm at this rate, it would require figures like those of the distance to the nearest fixed star.

MEDICINE AND HYGIENE.

THE USE OF POWERFUL REMEDIES.

BY J. B. MORRISON, M. D., MARYVILLE, MO.

There is a class of remedial agents used pretty extensively in the practice of medicine, which agents are so potent, so very powerful in their influence upon the animal system, that their use in the hands of practitioners generally, is begining to create considerable apprehension. The class referred to is that denominated narcotics or arterial sedatives, such as Veratrum Viride, Aconite, Gelseminum, Prussic acid, etc. It may be said at the outset, that these powerful agents are not without their excellent qualities and their usefulness, when carefully and properly handled; but a little negligence in the administration of them, may prove to be a very serious, and, I may say terrible, thing. As a rule, the human family value life very highly; too highly to have it jeopardized by carelessness or by over-confidence of those who assume, or are authorized, to take upon themselves the protection of the same.

These agents are so overwhelmingly powerful, that their administration, in one-drop doses, has to be watched by a careful physician or by an experienced and conscientious nurse, with a scrupulous vigilance. When we reflect that there are many careless physicians in the practice of medicine, not wanting in learning, and not without the inevitable sheepskin, authorizing them to "fall on," as well as very many *home-made* physicians who "fall on" without authority; and when we reflect that this class, or these classes, are just as apt to be upheld by the secular press as those who are not only possessed of honorable and honored diplomas, but who are also careful, vigilant, assiduous, conscientious, and life-respecting. I say, when we thus reflect, the question may well be asked, should not such treacherous or dangerous agents be set aside.

A gentleman was once asked if he thought all men would go to Heaven. His answer was, "yes, if you allow me to select the men." I may be asked if I would not allow or sanction the use of these remedies under any circumstances. I answer, yes, if you will allow me to select the physicians and the nurses. I am aware that these very articles of which I am apprehensive are used with excellent effect in hospitals and in many families where tne physicians are within a few minutes' call and the nurses well trained and vigilant from necessity; but it is a patent fact that the great majority of the sick are not thus fortunately placed.

Since beginning the practice of medicine (1861), I have seen a number of cases in counsel where the patients died, I firmly believe, from the injudicious use of these agents—especially aconite—and not from pneumonia or other diseases. Experience of this kind, long since determined me not to use them except in very rare instances and then only under very strict guard. The result is that I have seldom made use of them in practice, nor do I now use them, and yet I think that I can show as favorable results in practice as those who use them —even if they lose but one patient in five or ten years by their accidental or otherwise misuse. There are much safer remedies that will fulfill the same indications, and why not use them? especially as the doctrine of specifics has but few advocates at the present day. If they were used on account of some well authenticated specific effect, there would be the more excuse for employing them and running the risk of accidents; but they are not used on such accounts, but are simply selected from a class to fulfill general indications. Some years since, an acquaintance of mine, was attacked by a threatening cold and cough, so threatening that he very early resorted to remedies, and in the cough mixture that he used he had incorporated some dilute hydrocyanic acid. He was not so careful as he should have been about taking the doses, and soon he was attacked with irregular heart-action, s › that he became alarmed and sent for neighboring hypsicians.

Aconite, in very small doses, has an effect on many persons that is very disagreeable, if nothing more, and that effect is a constant and very annoying swallowing—a very peculiar sensation in the throat, that causes constant deglutition. This probably is an idiosyncrasy with many persons, as it unmistakably is with myself, and wise physicians will respect idiosyncrasies. The advice of "the fath-

er of medicine" is not sufficiently heeded at the present day, *i. e.*, "if you can do no good, be sure that you do no harm." There is too great a desire among the young disciples to find something new, something that the old fathers knew nothing about; but in my humble judgment, it is pretty difficult to do. The fathers have told us that these remedies are uncertain in their action, and dangerous. Every now and then we see an account in the medical journals of a case, or cases, of poisoning from the use of these deadly articles. Whilst physicians should guard against becoming old fogies, they at the same time should be careful not to rush heedlessly into customs or habits that will endanger the lives of the people. They should aim to steer between the rock and the whirlpool.

CHECKING THE SPREAD OF SCARLET FEVER.

The very notable experiment which was tried by Dr. Ashby, Medical Officer of Health for Grantham, England, in dealing with the summer outbreak of scarlet fever in that town, has deservedly attracted much attention. The plan resorted to was that of isolating the patients in tents. He prevailed upon the local authorities to erect a tent hospital on the outskirts of the town, and induced parents to send their sick there; the result was most successful. Parents availed themselves of the tents largely—their early prejudice against any such arrangement being readily overcome—the patients did remarkably well and the spread of the disease was unquestionably much curtailed.

HYGIENIC CONDITIONS OF COAL MINES.

Some interesting information as to the way in which the human system is affected under the peculiar conditions of work in mines, has been furnished by M. Fabre, from experiences connected with the coal mines of France. He finds that the deprivation of solar light causes a diminution in the pigment of the skin, and absence of sunburning, but there is no globular anæmia—that is, diminution in the number of globules in the blood. Internal maladies seem to be more rare. While there is no essential anæmia in the miners, the blood globules are often found smaller and paler than in normal conditions of life, this being due to respiration of noxious gases especially where ventilation is difficult. The men who breathe too much of the gases liberated on explosion of powder or dynamite suffer more than other miners from affections of the larynx, the bronchia and the stomach. Ventilation sometimes works injury by its cooling effect.

SALT AS A PROPHYLACTIC IN DIPHTHERIA.

In a paper read at the Medical Society of Victoria, Australia, Dr. Day stated that, having for many years regarded diphtheria, in its early stage, as a purely

local affection characterized by a marked tendency to take on putrefactive decomposition, he has trusted most to the free and constant application of antiseptics, and when their employment has been adopted from the first, and been combined with judicious alimentation, he has seldom seen blood-poisoning ensue. In consequence of the great power which salt possesses in preventing the putrefactive decomposition of meat and other organic matter, Dr. Day has often prescribed for diphtheric patients living far away from medical aid the frequent use of a gargle composed of a table-spoonful or more of salt dissolved in a tumbler of water, giving children who cannot gargle a tea-spoonful or two, to drink occasionally. Adults to use the gargle as a prophylactic three or four times a day.

GAS TREATMENT OF WHOOPING-COUGH.

In the treatment of whooping-cough in gas works, as lately resorted to, especially in London, the purifying chamber consists of a large room with doors and windows freely open, and each contains twenty-four vessels, holding five cubic meters of depurating substance—lime and sulphate of iron mixed with sawdust—through which the gas has to pass. When the workmen are emptying and refilling these vessels, the children with whooping-cough are placed around it, and inhale the vapors which escape; they are in an atmosphere containing ammonium sulphide, carbolic acid and tarry products. As to the efficiency of this treatment, one physician reports that of 120 cases persevered with, in twenty there was entire failure, forty-eight showed improvement, and the rest were cures; it is thought, however, that it acts only upon one element of the malady, viz., catarrh.

BOOK NOTICES.

THE AMERICAN CYCLOPÆDIA. Entirely revised and fully illustrated, with maps and engravings, 16 volumes octavo, D. Appleton & Co., New York. For sale by L. B. Bailey, Kansas City, general agent for Western Missouri.

About a quarter of a century ago the Messrs. Appleton commenced the publication of the New American Cyclopædia, having for its design "to furnish a condensed exhibition of the present state of human knowledge on the most important subjects of inquiry." Its editors were George Ripley and Charles A. Dana, aided by nearly one hundred collaborators in America, Great Britain and Europe. The work was conducted so ably and impartially that it speedily achieved the greatest popularity of any ever published in this country. It was virtually a library in itself, and its fortunate owner had little need to consult any other work of reference.

We have had it constantly at hand for years, beginning in 1858, and have found it of the greatest use in our studies and in our literary and scientific work at all times. At the close of the series—sixteen large volumes—it was found necessary, in view of the great progress made in all branches of learning, and especially on account of the important political and military events transpiring at the time, to commence a series of Annual Volumes; consequently, from 1861 to 1875, each year furnished abundant matter of value in history, geography, science, biography, etc., etc., for a volume, similar in size and arrangement of contents to those of the Cyclopædia.

This work was regarded at the time of its inception, and has been ever since, as a marvel of condensed learning and an inexhaustible source of information; but the wonderful developments and discoveries of the past twenty years have rendered a new edition necessary. The whole has been thoroughly revised under the direction of the original editors, Ripley and Dana, by a corps of learned associate editors and revisers who have brought it fully abreast of the times. The new work, although the word "new" has been dropped from its title, is incomparably complete in every department, and is copiously illustrated with engravings and maps by the most skillful engravers. It is just what is needed by every intelligent family, as well as by professional men and students, and it has received the highest encomiums from the most distinguished scholars and scientists of the country. By no means the least of the attractions of the Cyclopædia is its cheapness. It is printed on excellent paper and bound in the most substantial styles, and yet, as the publishers say, it is "furnished to purchasers at less than one cent per page." To those owning the first edition the publishers offer exceedingly liberal terms for exchanging, and to those who cannot afford to exchange, the Annual volumes are supplied and delivered at intervals to suit.

Mr. L. B. Bailey is the authorized agent of Messrs. Appleton & Co., for Western Missouri, and is ready to fill all orders, and receive applications for subagencies.

THE MUSEUM OF ANTIQUITY. By L. W. Yaggy, M. S., and T. L. Haines, A. M,; 944 pp., octavo, Wever &. Co., Kansas City and Chicago, 1880. For sale by R. Mathews.

It is unusual to find in a subscription book so many good qualities as are combined in this work. The print, paper, illustrations and binding are excellent, substantial and tasteful, but the contents and style are its chief claim upon the reader's attention. Of the first it is only necessary to say that the antiquities of Egypt, Greece and Italy, including Troy, Nineveh, Babylon and Pompeii, are fully and graphically described and illustrated, together with accounts of the domestic life, amusements, domestic utensils, employment, religion or mythology, fine arts and literature of the people, condensed from the writings of the discoverers themselves. Of the second, the reputation of the authors as scholars and writers is a sufficient guaranty.

The works of Layard, Wilkinson and other archæologists and discoverers have been drawn from liberally, as well as the museums of London, Berlin and Naples; while days were spent at Pompeii in investigating those wonderful ruins. All points of any interest to the reader are taken up and fully discussed, the result being that almost all facts that the student of any of these subjects could need, and which would cost him hours and perhaps days of labor to look up in the different authors, are brought together in one convenient volume and set forth in an attractive and reliable form.

Nearly two hundred engravings illustrate the text, most of which are new, giving the reader a clear idea of all the noted ruined temples, statuary, domestic utensils and weapons of the ancients.

The work is for sale by Mr. and Mrs. R. Mathews, who have the general agency for Kansas City.

ARCHÆOLOGY. Vol. VII of the U. S. Geographical Surveys; quarto, pp. 497; Government Printing Office 1879.

We are indebted to Professor F. W. Putnam, curator of the Peabody Museum and editor of the above named work, for the copy before us. It is a magnificent volume, printed in the finest style and illustrated with a frontispiece sketch, twenty plates and one hundred and thirty-five text cuts. The contents of Part I are the General Report of Professor Putnam upon the Archæology and Ethnology of Southern California; the report of Dr. H. C. Yarrow, U. S. A., upon Chipped Implements; of C. C. Abbott, upon Mortars and Pestles, Steatite Cooking Pots, Plates and Food Vessels; on the method of manufacture of Soapstone Pots, by Paul Schumacher; on Articles made of Wood, and on Smoking Pipes of Stone, by C. C. Abbott; on Perforated Stones, (such as hammers, spindle whorls, weights for digging sticks, net sinkers, etc.,) of California, by the editor; on Miscellaneous Objects made of Stone, by C. C. Abbott; on Implements and Weapons made of Bone and Wood, by C. C. Abbott and F. W. Putnam; on Textile Fabrics, Basket Work, etc., and upon Ornaments, by the editor; on Beads, by S. S. Haldeman; on Iron Implements and other articles obtained by contact with the Europeans, by the editor; on the Crania from the Santa Barbara Islands, by Lucien Carr; Translation of the Voyage of Cabrillo along the Pacific coast in 1542, with introductory notes, by A. W. Henshaw.

Part II is devoted to the Pueblo Ruins and the Interior Tribes, by Prof. Putnam, and is mostly made up of the reports of G. Thompson upon the Pueblos and their Inhabitants, The Pueblo of Acoma, by Dr. Oscar Loew; The Pueblo of Taos, by Dr. H. C. Yarrow, U. S. A., and Lieut. Chas. C. Morrison, U. S. A.; The Pueblo of San Juan, by Dr. H. C. Yarrow, U. S. A.; The Cachina at the Pueblo of Zuni, by Francis Klett; The Ruins in New Mexico, by Dr. Oscar Loew; Ruins visited in New Mexico, by Lieut. Rogers Birnie, U. S. A.; The Remains of Population observed in Northwestern New Mexico, by Prof. E. D. Cope; Notes on the Implements of Stone, Pottery and other objects obtained in

New Mexico and Arizona, by the editor; Classification in seven Linguistic Stocks of Western Indian Dialects contained in forty vocabularies, by Albert S. Gatschet. By this extended statement of the contents of this work, it will be seen that it is the most comprehensive and complete report on archæology yet made, and a most useful and desirable compendium. The engravings and cuts are exquisitely well done.

SPAIN AND THE SPANIARDS. By Edmundo De Amicis; octavo, pp. 438; G. P. Putnam's Sons, New York, 1881. $2.00. For sale by M. H. Dickinson.

This work, translated from the Italian by Wilhelmina W. Cady. comprises a series of sketches, handsomely illustrated, of the most celebrated cities of Spain such as Barcelona, Saragossa, Burgos, Valladolid, Madrid, Aramjuez, Toledo Cardova, Seville, Cadiz, Malaga, Granada and Valencia. These are all described with a sort of enthusiasm and power which recalls our school-boy idea of the Italian character and causes us to rebuild the "castles in Spain," which long ago vanished with other illusions of youth. Everything is seen by Amicis with eye of admiration, and it is difficult to decide what pleases him most, the *senorita* with their "great eyes full of sweetness," the cathredral of Burgos with its masterpieces of sculpture and painting, Valladolid, the Rich, with its famous picture gallery in the college of Santa Croce and its traditions of Christopher Columbus the Prado, the Recoletos and other promenades of Madrid, its splendid theatre and cafes, armory and museums, its unsurpassable Royal palace, its bull fights which he visited every Sunday, and to a glowing description of which he devote thirty-one pages; its cock fights, which he did not enjoy; Toledo, perched upon its steep and rocky heights, and approached by the famous bridge of Alcantara with its labyrinthine streets so narrow that the hubs of the wheels almost touch the walls of the houses, its ancient bas-reliefs, arabesques, Moorish windows and statuettes; Cordova, the ancient pearl of the East, the city of the thirty suburbs an three thousand mosques; Seville, the queen of Andalusia, the Spanish Athens the city of poets and lore; or of famous Granada to whose magnificent promenade, the Alameda and ancient Arabian castle, the Alhambra, he devotes h most earnest and graphic descriptions. The whole book is bewitchingly interesting, both from the fascination of the subjects themselves, and also from the fin colors with which this Italian word-painter depicts them.

THE STORY OF A SCANDINAVIAN SUMMER. By Katharine E. Tyler; 8mo., pp 394; Putnam's Sons, New York, 1881. For sale by M. H. Dickinson, $1.75

Since Bayard Taylor recorded his observations and impressions of the Nors lands in 1857, in his book "Northern Travel," no American author has writte anything on the subject until Miss Tyler gave her notes on Norway to the publ under the above rather captivating title, and it must be admitted that there is co

derable similarity in the manner of observing and describing the scenery, peo-le and other objects of interest by these two writers; *i. e.* a kind of newspaperish yle that is hardly satisfactory in the formal shape of a book. Nevertheless, iere is much good and instructive reading in this volume, notably the chapters ntitled "Down the Romsdal and Back," and "Up to the Midnight Sun," from ie latter of which we make the following extract: "The sea was as clear and ill as a mirror, reflecting all the lovely tints of mountains and sky. By and by e steamed out of the shadow; and as we passed beyond the dark mountain a w minutes before twelve o'clock (midnight) the sun was shining in dazzling lendor, apparently about two degrees above the horizon line of sea. It dropped o lower, but soon began to ascend gradually, appearing above the summit of the ext mountain that interposed. The gentlemen greeted the sight with three ieers, adding another for 'Gamle Norge,' (Old Norway). Some of them tried burn holes in their hats with glasses; and I think one of them succeeded after ng labor, but there was not much heat in the rays. The effect of the golden ght was wonderful, and the glaring reflection on the glassy surface of the sea om the North Cape itself, could hardly have been more glorious."

The book is filled with information regarding the mythology and ancient his-ry of the Scandinavians, as well as the modern customs and habits of the Nor-egians, and cannot fail to be of value to the reader. It is presented by the iblishers in very handsome style.

ALARIA: WHAT IT MEANS AND HOW AVOIDED. Joseph F. Edwards, M. D., Philadelphia; Presley Blakiston, 1881; 12mo., pp. 81. 75c.

This little volume is divided into four parts, viz: What is Malaria? Where Malaria found? Symptoms and signs of Malaria. How to avoid Malaria. ie first chapter is devoted to showing the difference between Miasma and Ma-ia, and to impressing upon the mind of the reader that the latter is simply "bad ." The second proves that the atmosphere is contaminated in a thousand ways which people generally are not aware, and points out many of them. The rd shows that the symptoms of Malaria are so manifold and various that it is possible to enumerate them. The fourth declares that cleanliness of person, ellings and streets, and purity of atmosphere and water, are the chief means avoiding malaria.

E ART OF SPEECH. Studies in Eloquence and Logic, by L. T. Townsend, D. D.; 18mo., pp. 269; New York, D. Appleton & Co. Cloth, 60c. For sale by M. H. Dickinson.

After quoting the definitions of eloquence, by various authors, ancient and dern, Dr. Townsend concludes that eloquence, as an art, is such a represen-on of thought in vocal, written and gesture language as is adapted to persuade. a science, eloquence is the theory of the processes of so expressing thought

as to persuade. Eloquence is, therefore, the art and science of persuasion. Or tory, as an art, is such an exercise of rhetorical skill in oral discourse as is i posing and impressive. The science of oratory is the classification and systemat arrangement of the rules of oratorical art. Oratory is, therefore, the art a science of producing strong impressions by means of oral speech. Eloquenc strictly speaking, generates volition; oratory generates conviction. On this fou dation the author builds his work, beginning with the history of eloquence a leading off into its various departments, with illustrations from Demosthene (whose Oration on the Crown he analyses fully,) Cicero, Chalmers, Broughai O'Connell, Webster, Choate, and many other recognized orators. His "Inf ences" are admirably drawn and stated, and as a book of instruction in the theo and frame work of oratory, the Art of Speech is a success.

Text-book of Experimental Organic Chemistry for Students. By I Chapman Jones; 16mo., pp. 145; Van Nostrand & Co., 1881.

This book is not intended by the author as a text-book of organic chemistr but merely as a laboratory companion for the student who wishes to follow tl branch of science practically, as well as theoretically, and especially for th who have but a limited amount of time at their command. The peculiarity the work is, that in every division appropriate typical experiments are suggeste so that the student who follows out these suggestions with any degree of ca will necessarily acquire a permanent knowledge of at least that particular branc The subjects discussed thus experimentally, in Part I, are the Cyanogen Co pounds, the Hydro-carbons and their more immediate derivatives; the alcohols, t ethers, the aldehydes, the acids, the ethereal salts. In Part II the Reactions a Detection of certain organic acids are pointed out; also the methods of dete ing them by analysis.

The simplicity of the explanations and the experiments is the chief reco mendation of the book, as it enables students to proceed with their work w very little assistance from professors or teachers. The practical character of t subjects discussed is another advantage to this class of students, who are m likely than others to need to apply their knowledge to the practical affairs of li

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OTHER PUBLICATIONS RECEIVED.

The cultivation of Pyrethrum and manufacture of the powder, use of Pyre rum as an insecticide, Prof. C. V. Riley. Apportiontment under the 10th Cen of the United States, with remarks, by Hon. S. S. Cox; Subjects and Questic pertaining to Political Economy; Usury Laws, their nature, expediency and fluence, by R. H. Dana, Jr., David A. Wells and others, 10c.; Semi-annual F port of the Comptroller of the City of Kansas for six months ending June 1881; Annual Report of the Board of Trade of Minneapolis, Minn., 1880; I

rt of Proceedings of Polytechnic Association October 29, 1881, T. D. Stetson, esident; Ephemeris of the Satellites of Mars, for the Opposition of 1881, Prof. . S. Pritchett, Washington University, St. Louis, Mo.; Rules of the Probate urt of Jackson county, Mo., Judge O. P. W. Bailey.

SCIENTIFIC MISCELLANY.

UNVEILING OF THE MUDGE MONUMENT.

JOSEPH SAVAGE, CHAIRMAN OF MUDGE MONUMENT COMMITTEE.

The ceremonies of unveiling the Mudge monument were performed, with ropriate exercises, at the grave of the late Prof. B. F. Mudge, in the cemetery unds at Manhattan, Kansas, on the 12th ult.

Quite a large delegation of members from the Academy of Science arrived the city on the night train to take part in these interesting exercises. The day s bright and beautiful—almost a copy of the Professor's last on earth, the ond anniversary of which occurs nine days later. Carriages were kindly nished by the citizens of Manhattan to convey the visitors and friends to the unds, which are situated upon an eminence, one and one-half miles from the iness part of the city. The procession was formed at 10 o'clock A. M. in nt of the Adams House, and was led by the family and friends of the deceased, Odd Fellows, who were out in full regalia, forming an escort upon either e.

At the cemetery grounds, quite a large assembly had collected from the surnding country to share in these dedicatory exercises. Prof. J. T. Lovewell, Washburn College, President of the Kansas Academy of Science, called the eting to order; and, by a few well chosen remarks, introduced the exercises he occasion. He referred to the many years of labor in the fields of scientific loration that the deceased had bequeathed to the State; to the debt of grati- e due him for all these services; that this monument, with its spire pointing venward, not only gave expression to this feeling, but was here to tell future erations that here lies the dust of him we loved, revered and honored.

Mr. Joseph Savage, of Lawrence, was next called upon to represent the e University and his section of the State. He spoke of his long acquaintance the deceased, as companion, friend and teacher, and alluded to the first of a monument, which came to him almost two years ago like an inspiration; also of the cordial support the friends of the project had everywhere receiv- the joy all must now feel at the completion of this "labor of love," now so itifully represented in the monument before us—tears crystalized in marble.

Mr. Savage was followed by Hon. I. T. Goodnow, of Manhattan, in a de-

scription of the plan of the monument, its form, its various kinds of stone, an their colors and combinations.

It is composed of seven pieces. The lowest base is Dunlap, Morris county light-colored limestone, representing his adopted State—the home of his ripe years The next base is red beach granite, from Maine—the State of his birth The third base is gray granite from Barre, in the Green Mountain State. The fourth base is a beautiful dark Quincy granite, from Massachusetts—the Sta where he was educated and grew up to manhood, his parents moving there in h infancy. The fifth stone, the die, is a beautiful variegated, light-colored marbl with pinkish tinge, and narrow, dark zigzag lines running through it. The sixt stone is a dark-colored La Panto marble with dark red spots, a rare stone fro Rutland, Vermont. The seventh stone or shaft is marble from Knoxville, Te nessee—the same as the die—in all making the whole monument fifteen feet eigl inches in height. The monument in form and color has elicited almost univers approval, with little if any adverse criticism.

Mr. Goodnow was followed by Rev. R. D. Parker, of Manhattan, who sa that it was within the circle of these hills, that the deceased in company with h brother, J. D. Parker, now at Kansas City, Mo., first conceived the idea forming the Kansas Academy of Science, which, for the last fourteen years, h been an accomplished fact.

Rev. E. Gale, of Manhattan, followed in some interesting remarks, contras ing the scenes which must have occurred in the "long ago," around a buri mound upon yonder hill-top, (Bluemont, probable burial place of mound-builder and scene of Prof. Mudge's last geological labors,) with the exercises of the pre ent time. Prof. Gale was for many years an associate teacher with Prof. Mud in the Agricultural College.

Prof. Robt. Hay, of Junction City, claimed the right of being a lover geological science, and as a co-worker in this great field of discovery and explo ation, he would offer his tribute of love and praise to the memory of our depart friend. He also offered a resolution of thanks to Mr. W. S. Reed, of Lawrenc Kas., the builder of the monument, for his fidelity and faithfulness in performi his part of the contract so well. The resolution was unanimously adopted. M Reed is rapidly rising in his vocation, and the monument demonstrates his ski

Mr. Savage, upon request, gave a short explanation of the quotation p upon the monument, viz: "There is a Land that is Fairer Than Day." H spoke of the intense pleasure scientists all feel in finding something new in natu —a pleasure almost akin to a new creation. His own heart had throbbed unison with Prof. Mudge's on many occasions of this kind, and he readily r called to mind the unvarying habit of Prof. Mudge, upon finding anything ne or old, of breaking forth into this song while unearthing his new found treasur Therefore, the committee had thought it fitting to inscribe this couplet upon l tombstone: "There is a Land that is Fairer Than Day." Prof. Platt then su gested the singing of this hymn by the audience, which was done with evide feeling by all present.

The benediction was then pronounced by Rev. R. D. Parker, and the audience dispersed, all feeling that it had been good for them to be there.

Rest, then, thou precious dust of him we so dearly loved, and sweetly sleep beneath this grass-covered mound, these fresh cut flowers, while at thy side this monument shall ever stand, pointing, with unerring fingers, to that "land that is fairer than day," where no light is, but where God is thy light.

THE DEMANDS OF THE MISSISSIPPI VALLEY.

The River Convention which met at St. Louis, last month, passed resolutions urging Congress to make a liberal appropriation for the improvement of the Mississippi. Since compliance with this request will benefit directly half of the States and more than half of the territory of the Union, it is but reasonable to suppose that it will be granted. The main argument in favor of it is concisely stated by the *Globe-Democrat* as follows:

The rivers of the Mississippi system pass through or border nineteen of the thirty-eight States, or just one-half of all, to say nothing of three great Territories, the Indian, Dakota and Montana.

Nor are these waters, even in the most remote communities, mere trout brooks, but navigable and actually navigated streams. Of the nineteen States tributary to the Father of Waters, fourteen are practically Valley States, having interests which are to a great extent under the River's influence. The others, as New York, Pennsylvania and Alabama, though sending important currents into the great central artery, are less affected by it. Among the Valley commonwealths proper are the great, central and rapidly growing communities of Ohio, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Nebraska and Kansas —States of more material value to the Union than any other nine that can be picked out.

The area of the nineteen river States is 1,208,977 square miles, while the nineteen non-river States count up only 855,752 square miles. Over 350,000 more miles of country contribute to the grand aqueduct than are comprised in all the rest of the United States. This surplus is enough to allow New York, Pennsylvania, West Virginia and Alabama to be thrown out of the list of river States altogether, with a good slice of Texas besides. The Mississippi basin, all told, including its headwaters in all the States and Territories, comprises a drainage area of nearly 1,260,000 square miles.

THE SONG OF THE CARBONS.

[The universal physical law of molecular vibration is finely illustrated in the carbon pencils of the electric arc light used in some of the largest lighthouses. The molecular stir set up in the armatures of the dynamo machines by rapid

magnetization and demagnetization is transmitted to the carbon points of the lantern, and reappears as a distinct musical tone.]

A weird, sweet melody, faint and far,
    A humming murmur, a rhythmic ring,
Floats down the tower from where the lenses are
    Can you hear the song which the carbons sing?

Millions of æons have rolled away
    In the grand chorale which the stars rehearse,
Since the note, so sweet in our song to-day,
    Was struck in the chord of the universe.

The vast vibration went floating on
    Through the diapason of space and time,
Till the impulse swelled to a deeper tone
    And mellowed and thrilled with a finer rhyme.

Backward and forward the atoms go
    In the surging tide of that sounding sea,
Whose billows from nowhere to nowhere flow,
    As they break on the sands of eternity.

Yet through all the coasts of the endless All,
    In the ages to come, as in ages gone,
We feel but the throb of that mystic thrall
    Which binds, responsive, the whole in one.

We feel but the pulse of that viewless hand
    Which ever has been and still shall be,
In the stellar orb and the grain of sand,
    Through nature's endless paternity.

The smile which plays in the maiden's glance,
    Or stirs in the beat of the insect's wing,
Is of kin with the north light's spectral dance,
    Or the dazzling zone of the planet's ring.

From our lonely tower aloft in air,
    With the breezes around us, tranquil and free,
When the storm rack pales in the lightning's glare
    Or the starlight sleeps in the sleeping sea,

We send our greeting, through breathless space,
    To our distant cousins, the nebulæ,
And catch, in the comet's misty trace,
    But a drifting leaf from the tribal tree.

The song we hum is but one faint sound
In the hymn which echos from pole to pole,
Which fills the domes of creation's round,
And catches its key from the over-soul.

And when it ceases all life shall fail,
Time's metronome shall arrested stand;
All voice be voiceless, the stars turn pale,
And the great conductor shall drop his wand!

—*Springfield Republican.*

EDITORIAL NOTES.

Dr. E. R. Heath, the accounts of whose explorations in South America have been of so much interest to the readers of the *Review* during the past two years, has returned home. After reaching this country he delivered several lectures, descriptive of his travels and the regions he explored, in New York and Philadelphia, under the auspices of various learned societies. These lectures were well attended and highly appreciated by his auditors. He will remain with his brother Dr. Ivon D. Heath, at Wyandotte, Kansas, during the winter. His lecture before the Kansas City Academy of Science on the 29th ult. was delivered after the Reveiw for December was in print.

The Kansas City Board of Education, having a nucleus of a public library numbering about 3,000 volumes, and a moderate fund on hand from individual donations, is enlarging its accommodations and is about to purchase a quantity of new books. This Library is becoming very valuable by reason of the good judgment exercised in the selections made heretofore, and if properly fostered and encouraged by the citizens, will, before many years, be the pride of the city.

Prof. L. A. Thomas, formerly principal of the Topeka schools, died November 11th at his residence in Topeka, of quick consumption. Mr. Thomas was an educator of rare ability and possessed many traits of character that greatly endeared him to those with whom he was associated. His loss is one that will be keenly felt in the educational ranks of the State.

Patrons of the *Review* will please remember that they can procure all of the periodicals of the day at 15 per cent below the regular subscription rates by ordering through this office. Also any book published by any of the prominent publishers, at 20 per cent below retail prices.

Prof. S. W. Burnham, the noted astronomer of Chicago, passed through this city on the 23d ult. on his way from California, where he had been for the past month in company with Professor E. S. Holden, of Madison, Wisconsin, visiting and inspecting the Lick Observatory, and observing the transit of Mercury.

Prof. Ernest Ingersoll, of the United States Fish Commission, made a brief call at this office on the 22d ult. He has been, for several months past, engaged in exploring the ancient ruins and other objects of interest along the line of the Denver & Rio Grande Railroad in Colorado and New Mexico. The results will soon be published in a handsome illustrated volume, and will, doubtless, meet with a ready sale.

JUDGE E. P. WEST, who has contributed several valuable archæological articles to the *Review*, in the past, is now engaged in an exploration of the Mound Builders' works along the banks of the Missouri river between here and Jefferson City, in the interest of the Daily *Times*, to which paper he sends an interesting report of his labors weekly.

BY a typographical error the word "Miso" in Professor Penhallow's article in the November *Review*, was misspelled "Meiso"; and in the second line of page 437 the word "rice" should be substituted for "miso."

A COMPANY has been formed in St. Louis for the purpose of manufacturing and supplying hydrogen gas for heating and power for dwellings and factories. The gas is generated under the Law process, which has been successfully applied in several eastern cities. The works are the largest and most extensive in the country, and when in operation will have a capacity of 300,000 cubic feet per bay. The gas is not adapted for illumination, and will only be supplied to tenants requiring it in place of coal for raising steam in ordinary boilers and for running gas engines, in which work it is superior to coal gas, furnishing greater pressure and only at a cost of $1.50 per 1,000 cubic feet.

The process can be briefly illustrated, as follows: Anthracite coal is fed to an upright generator, where it is worked up to a white heat by the agency of a blower, which is driven at a high rate of speed by a fifty-horse-power engine. As soon as the coal arrives at the proper heat, super-heated steam is admitted, and, impelled by the pressure of the blast, passes through the furnace and thence through super-heating chambers and carburetters. In the passage the generated gas is washed, and after passing through a series of tile pipes is returned to the condenser ready for distribution to the consumer. The surplus supply is conducted to a gas holder in the yard which has a capacity for storing 30,000 cubic feet. The power required in manufacturing the gas is supplied by a sixty horse power boiler and an ordinary engine of the same power. After operations begin the steam engine will be supplemented by a gas motor.

Connections will be made with manufactories through ordinary fifteen-inch iron pipes, which will be laid underground in the same manner as gas pipes. For private houses and hotels, where the gas will be used as fuel, smaller mains will be employed. The condensation is so slight that it is not considered necessary to encase the pipes in asphaltum, cement or any other non-conducting materials, and it is claimed that an efficient service will be obtained by these means.

GENERAL SHERMAN makes the very sensible suggestion in his annual report that the President authorize the transfer, out of class-enlisted men who have served for twenty-five years or more, a number not to exceed 500, including ordnance sergeants (now 112) and establishing a "veteran corps," to be stationed at such old forts as are worth preserving, with the rank and pay they held at the close of their active career in the army service, to be subject to the rules and articles of war, but only to be used for guarding public property. He says one or two officers of the retired class and half a dozen of these old soldiers would compose a good garrison for an abandoned post or fort. By granting retired officers thus detailed, fuel and quarters, we would provide homes for worthy veterans, which would be most honorable and creditable to them and advantageous to the government. At the same time the army proper would be relieved from such duty, and its able-bodied men put at their legitimate work in the field.

EXTENSIVE zinc smelting works are being erected at Rich Hill, in this State. They are to occupy thirteen acres of land, and will comprise seven large buildings, costing $50,000.

THE National Academy of Science met in the hall of the University of Pennsylvania, in Philadelphia, on the 15th ult. Among other matters of importance was the appointment of a committee to conduct the observation of the transit of Venus in 1882.

SIGNOR ANGELO POSSI PONTI, after a long study of the peculiar geology of the petroleum region of Pennsylvania, concludes that the causes of the volcanic forces in Mt. Vesuvius are the same as those which produce the gases in the oil region, and proposes by boring near the mountain's base to draw off and utilize for mechanical purposes the vast accumulation of oil which has for ages been feeding the flames. He prudently offers to attempt it *after* stock to the amount of $500,000 has been subscribed and paid in for that purpose.

DR. HAHN'S discovery of fossil organisms in meteorites, has stirred up a lively discussion among the *savants*. Charles Darwin is reported to have declared his faith in their presence in the specimens presented for his examination, and pronounces the discovery a most important one.

THE State coal shaft, at Leavenworth, Kansas, is 732 feet deep, including a sump of nineteen feet, to catch the dripping water, which accumulates at the rate of sixty-five gallons an hour. The main shaft is 10x16 feet, and the air shaft, or up-cast, 4x10 feet. The working face of the mine is about 1,200 feet long, and extends entirely around the mine at a distance of 125 feet from the shaft. There are at present forty-nine men working at the shaft, who are getting out about 1,200 bushels of coal a day.

THE suggestions made by Mr. W. L. Campbell, of this city, to the Missouri River Improvement Convention that met at St. Joseph on the 29th ult., were eminently practical, showing a careful study of the wants of the West and the best manner of meeting them. If adopted by the Convention and carried out by Congress our River will assume the commercial importance commensurate with its size and the immense country it drains.

WE call attention to the advertisement, in this number, of the Noyes' Dictionary Holder. It is an improvement upon anything of the kind that we have seen, not only in style and stability, but also on account of the attachments or racks for magazines, etc.

ITEMS FROM PERIODICALS.

THE December issue of the *Popular Science Monthly* is the second number of Vol. XX, which means that about ten years of the life of that most valuable and popular magazine have glided away already. In this time it has furnished its patrons more than 16,500 pages of the best untechnical scientific matter, original and selected, that has ever been offered the general reader in this country. $5.00 per annum.

This magazine, as well as all other prominent periodicals, can be procured through this office by subscribers to the REVIEW, at club rates.

THE *American Young Folks*, published at Topeka, Kansas, by Messrs. Longshore & Smith, was established in 1875, and is the best and cheapest periodical in the West for boys and girls. It is an eight page quarto, issued monthly, well edited, full of illustrations and furnished postpaid to subscribers for 50c per annum.

MESSRS. HOUGHTON, MIFFLIN & CO., have secured the exclusive control of the *Edinburg Reveiw* and the *Quarterly Review* in the United States. These, together with either of the other periodicals published by this well known house, viz: the *Atlantic*, the *Boston Medical Journal*, the *Law Reporter*, and *Dwight's Journal of Music*, can be obtained by subscribers to the Kansas City REVIEW OF SCIENCE AND INDUSTRY, at club rates.

WM. HOSEA BALLOU, of Evanston, Ill., read a valuable and comprehensive paper at the Cincinnati meeting of the American Association for the Advancement of Science, upon the White Pine, its origin, reproduction, insectivorous enemies, natural history and statistics of the industry. The matter furnished is well chosen and admirably condensed, making an article worthy of preservation.

The Evolutionist at Large, by Grant Allen, is the title of the Humboldt Library No. 26. Price, 15 cents. J. Fitzgerald & Co., New York.

One of the best articles found in the Proceedings of the Kansas State Dental Association for 1881, just received, is that of Dr. R. Wood Brown, of this city, upon "Teeth and Brain," which was so well received by our Academy of Science last season.

The *American Antiquarian and Oriental Journal*, Vol. 4, No. 1, T. H. Bush, Publisher, Chicago, Ill.; Rev. Stephen D. Peet, Editor, Clinton, Wis., presents this attractive table ot contents; Prehistoric Europe, a summary, By L. P. Gratacap; Were the Mound Builders Indians? By D. G. Brinton, M. D.; Prehistoric Relics in Egypt, (a review of Brugsch Pasha's address,) By O. D. Miller; Legends of the Iroquois, By Mrs. Erminnie C. Smith; Polyandry in India, By Prof. John Avery; The Site of Capernaum, By Prof. J. Emerson; The Three Temples Compared—Greek, Hebrew and Egyptian, By Rev. S. D. Peet. Correspondence—Sea Shells in Mounds—Gentes and Phratres. Editorial Department—Oriental Congress, Mummies in Egypt, Siloam Inscriptions, Linguistic Notes, Oriental Notes. Recent Intelligence, General Review, Book Reviews.

We have received from Prof. J. T. Lovewell, the catalogue of officers and students of Washburn College, Topeka, Kansas, for the year 1881–2. From it we learn that the institution is in a flourishing condition, and that it will graduate its first senior class this year. The course of study in all departments is full and thorough, and the means of illustration are unusually good. It is one of the best colleges in the west.

Dr. Stephen Bowers, who has been publishing the *Weekly Herald*, at Clinton, Wis., has purchased the office of the *Beloit Outlook*, Beloit, Wis., where he will edit and publish the Daily and Weekly *Outlook*. The *Herald*, under his management, has been a success, and this still wider field will, doubtless, prove more successful.

The *Atlantic Monthly*, for December, presents the following choice table of contents: Dr. Breen's Practice, 11, 12, W. D. Howells; Origin of Crime in Society, 2, Richard L. Dugdale; Shakespeare and Berlioz, Theodore Child. The Portrait of a Lady, 53, 55, Henry James, Jr.; The Parting of the Ways, W. C. L.; The Habitant of Lower Canada, Edward Farrer; British State Assassins and the Defense of Insanity, James W. Clarke; Hester's Dower, S. A. L. E. M.; Socialists in a German University, Willard Brown; At Canterbury, Harriet W. Preston; Caste in American Society, Kate Gannett Wells; Pyrrhus' Ring, Edith M. Thomas; East of the Jordan, and other Books of Travel, Charles G. Leland; Buddha and Early Buddhism; Mark Twain's New Departure; The Contributors' Club; Books of the Month.

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GEOLOGY.

MARBLE OF SOUTHEAST MISSOURI.

BY PROF. G. C. BROADHEAD.

When connected with the Missouri Geological Survey I have, at various times during the past twenty-five years had my attention directed to the marble quarries in southeast Missouri.

The late Henry Cobb during his lifetime spent some time and money in striving to introduce these rocks as an ornamental stone. The result of his labor was the construction of a few mantles and table tops, chiefly used in the city of St. Louis. But thus far no capital has been invested in the work sufficient to make the business of commercial importance. My recent investigations in working up the Quarry Industry of the Tenth Census has again brought these rocks to my notice. The Cape Girardeau limestone has been termed a marble by some. It is a white, coarse-grained limestone burning into pure lime, also affording very large dimension stone. The State Capitol of the State of Louisiana, at Baton Rouge, was built of this rock and constructed probably thirty years ago. It was partially burned down during the late war, and at present blocks of the same stone are being sent South to repair the building.

A building in St. Louis, on Fourth street near Locust, used for a long time as a drug store had its front constructed of this stone. The smoke and weath-

ering of over twenty years have caused it at present to have quite a weather-beaten appearance and the frost has probably opened a few argillaceous seams in it. Otherwise it seems durable.

The quarry shows about twenty feet thickness of white limestone, one bed of which is six feet in thickness. The upper ten feet is a little brown tinged, and contains the characteristic fossil *Receptaculites Oweni*, showing the beds to be Lower Silurian of the age of the Galena group. The west end of the quarry presents an interesting feature in having an intrusion of brown sandstone thirty feet in width and widening northwardly, connected with overlying sandstone strata beyond. There really had been a ravine in the limestone prior to deposition of the sandstone, subsequently deposited and resting on and flanked by the limestone. The lime-quarries at Glencoe, St. Louis County, Missouri, are of the same geological age as the Cape Girardeau limestone and burn into excellent lime. At Glencoe a fine specimen of *Illænus* (*Bumastus*) *trentonensis* was obtained.

The marble quarries proper of southeast Missouri are included in two groups. The older or lower are Potsdam, the others are Upper Silurian. The Potsdam quarries are found in Madison, Iron, and Reynolds, and are located on Stout's Creek, and Marble Creek in Iron; Cedar Creek, Marble Creek and Leatherwood Creek in Madison, and Tom Luck Creek in Reynolds County.

CEDAR CREEK MARBLE.

Near Little Vine church, near the head of Cedar Creek, are several outcrops of variegated red and drab marbles. A section of rocks on a southeastern branch of Cedar Creek shows ten feet of coarse magnesian limestone resting on ten feet of light drab marble of fine grain, traversed with brown veins. A section on west side of St. Francois River near mouth of Leatherwood Creek shows

1. Four feet rough beds of dark ash magnesian limestone.
2. Four feet of gritty dolomites.
3. Four feet of fine-grained magnesian limestone spotted with green.
4. Five feet of whitish and brownish limestone.
5. Three feet of gritty dolomites.
6. Five feet of coarse, brown spotted magnesian limestone.
7. Two feet of fine-grained magnesian limestone, color drab.
8. Four feet magnesian limestone.
9. Twenty feet outcrops of marble, light color, with calcite specks and resembling that found on Marble Creek.

The rocks dip at an angle of 22°, course south, 65° west, near Little Vine church. The marble beds are red and alternate with red conglomerate beds which contain porphyry pebbles.

The finest exposure and containing the most handsome varieties of marble is on the land known as belonging to the Cooper heirs near the mouth of Cedar Creek, Madison county. I have recently heard that it was being purchased by the Knob Lick Granite Company, who probably would develop it. The marble probably underlies two hundred acres. The rock here has been quarried in smal

quantities at long intervals, and is very handsome when polished. The colors blend beautifully. It really is thus far the best appearing marble in Missouri, both as to color, and arrangement of colors and texture. Its outcrop also shows it to be durable with no appearance of injury from frost after the wear of ages of exposure. Still, if used for outside work it would probably tarnish too much. For mantles and table tops it will probably compare with Tennessee or any other marble.

The oldest known outcrop shows a deep red rock with occasional small quartz crystals. The present excavation is small but shows beds from one foot to one and a half feet in thickness, said to be thicker below. The rock seems to be chiefly a pure limestone with many specks and lines of crystallized calcite, often a greenish shade around the cystalline facet blending off gradually into red, which often gradually deepens in color.

The quarry known as the "Rasnick" quarry is about four miles south of Ironton, on the head of Marble Creek, and the rock is here found for over a quarter of a mile apart or probably a half mile to distant outcrops. Most of the beds are rather shelly, but there are about two beds of good thickness, of uniform texture and handsome arrangement of colors.

Young's quarry on north side of Marble Creek, near east county line of Iron County, presents a face of twenty-five feet of rock extending for several hundred feet along the bluff. The texture is very fine and traversed by buff veins of coarser material. There are several other localities containing similar marble on the head branches of Marble Creek.

On Stout's Creek, four to six miles west of Ironton, are also outcrops of handsome marble. On head of Tom Luck Creek, in Reynolds County, are thick beds of flesh-colored marble.

At corner of Sections 5, 6, 7 and 8 of Township 32, Range 4, in Iron County, the beds appear thus:

1. Twenty-one feet of marble and conglomerate beds, including over twenty layers varying in thickness from a half inch to a foot.

2. Fifteen feet no rocks seen.

3. Twenty-two feet including beds of conglomerate, shales and marble, the latter shaded red, whitish and buff, but all in too thin beds to be valuable. Many layers being only a half inch thick, but the colors are all handsome and uniformly specked with calcite.

A general section of these marble beds as they occur in the northern part of Madison County is about as follows:

1. Magnesian limestone.

2. Eighteen feet of thick beds of silicious dolomite and thin shaly limestone with *Lingula lamborni*.

3. Twenty-three feet of gritty dolomite.

4. Five to thirty feet of marble.

5. Five to forty feet (as much as ninety feet near Mine La Motte) of sandstone.

6. A few feet of slaty sandstone resting on granite.

The presence of *Lingula lamborni* in beds a little above the marble will certainly assign the marble beds to the Potsdam group.

MARBLES OF NIAGARA GROUP.

Two miles north of Cape Girardeau, Missouri, on land of Dr. Thomas Holcombe, are outcrops of variegated purplish red limestone with occasional calcite specks. The bedding is thick and the marble would look well if polished.

Dr. Shumard in his geological report of Cape Girardeau County, Missouri, Geological Report 1855–71, makes favorable mention of this and other quarries. Dr. S. enumerates one hundred and forty feet of Niagara limestone one mile above Shephard's Landing, the lower eighty-two feet of alternations of purple, yellow, buff and gray with five feet of handsomely variegated limestone in the upper beds. Two miles north of Cape Girardeau his estimate gives

1. Twenty-six feet of laminated beds of brick red, sandy-textured limestone.
2. Thirty-two feet of fine-textured, red and purple limestone, clouded with yellow and green and containing *Calymene blumenbachii*, *Striatopora flexuosa*, and *Columnaria inequalis*.
3. Thick beds of bluish gray limestone with *Halysites Catenularia*.

He also speaks of the marble being found in Section 22, Township 32, Range 13. Similar beds occur in Perry County in east and northeast.

Dr. S. speaks of its occurrence at Janis' mill in St. Genevieve County, inclining at 80° to 90°, of fine texture and passing through various shades of flesh, yellow and green, pink, purple and chocolate, all handsomely blended.

Prof. Albert D. Hager now owns a small tract of land in St. Genevieve County, and is preparing to saw out slabs. Some specimens from this vicinity that I have seen show an exceeding beauty. I have seen also a specimen o dark chocolate color varied by darker wavy lines, all very handsome.

The chief drawback in working the marbles of southeast Missouri has bee the beds generally are too thin to work economically.

SHELLS OF EUREKA SPRINGS, ARKANSAS.

BY F. A. SAMPSON.

During the fall of 1880 and the past summer, I made four visits to this no famous health resort of northwestern Arkansas, and during those visits I spe much of the time collecting the land and fresh-water shells of the vicinity. Th shells of both classes are interesting, either from the rarity of the species, or fro their variation and perfection.

The place takes its name from a large number of mineral springs found wit in a radius of a mile or less; though all containing more or less mineral, this not apparent to the taste, and there does not seem to be anything in the wat

distasteful to water mollusks, and these are found in large numbers in certain places.

While a considerable volume of water flows from part of the springs, yet by reason of the large amount of gravel in the beds of some of the streams, the water disappears in a short distance, so that in the dry season these beds show no water. This is true of West Leatherwood Creek especially, and in places where there are springs giving a large volume of water, and possibly, in part at least, the same water which disappeared higher up stream, again sinks out of sight within a few rods from these springs. In this stream I found shells of two genera only, *Physa* and *Ancylus*, the latter only above the highest point where the water sank into the gravel. In June I found *Ancylus tardus*, Say, quite large and but few in numbers; six weeks later none were found of more than about half size, but these were very abundant. At this same time those found in another stream were somewhat larger than at the former time, while they were much darker in color. In this latter stream the size was about the same as in the November preceding. In the first mentioned stream *Physa gyrina*, Say, were found in large numbers; at the highest point the shells were the finest, while further down, at Sycamore Springs, they were badly eroded. In one of the branches of this stream *Physa heterostrophe*, Say, of small size was found in June with very clear and clean shell, while six weeks after they were of the same size but almost black.

Leatherwood Creek, the stream from the principal spring, not having so much gravel in its bed, does not go dry. In one of its upper branches I found the *Ancylus* before mentioned, and at the same place I found a single specimen each of *Pisidium abditum*, Hold, and *Limnæa numilis*, Say, the latter a dead shell, and the closest search did not discover any more of this species. Of the former, however, after making a small sieve, I obtained hundreds in a short time.

These were the only species found at the Springs, but in the White River, a few miles away, in addition to the *Unios*, I found, *Melantho decisa*, var. *integra*, *Sphærium sulcatum* Lamarck, *Pisidium compressum*, Prime, *Planorbis bicarinatus*, Say, *Physa heterostrophe*, Say, and several species of Melanions, of which two were *Pleurocera* and the others *Goniobasis*, they being found in great abundance.

The land shells were not found in large numbers, but more of them were rare species. During the dry weather the larger helices were found on the underside of the rocky ledges which extend on either side of the valleys and ravines. *Helix albolabris*, Say, was comparatively abundant, and on the highest grounds was smaller, heavier and darker than those found lower down. On the higher grounds were also found *Helix thyroides*, Say, *Helix exoleta*, Binn, and the fine, rare *Helix divesta*, Gould; none of them being found except at the highest points. Other rare species were *Helix labrosa*, Bland, *H. jacksonii*, Bland, and *H. dorfenilliana*, Lea, variety, all of them being confined to the higher grounds. The latter is the variety of which Binney says, "I am much inclined to consider this a distinct species, but remark upon it, as I believe it is more commonly found in cabinets under the name *dorfenilliana* than the shell described by Lea." *Helix Perspectiva*, Say, was found in considerable numbers:

a few, or in some cases a single specimen of the following were found: *Hyalina arborea*, Say, *Macrocyclos concava*, Say, *Helix alternata*, Say, *H. inflecta*, Say, *H. labyrinthica*, Say, *Bulimulus dealbatus*, Say, *Pupa armifera*, Say, *Zonites fuliginosa*, Griff., *Succinea* —, and *Helicina orbiculata*, Say. A small variety of *Helix fallax*, Say, was not uncommon, which was about half the size of the typical shell. I found a few albino specimens of it. On the cliffs of White River, *Helix roëmeri*, Pfeiffer, was obtained in small numbers.

There may be a few other species, but the total, not including the *Unios*, is not far from thirty-five, a number much smaller than is found in many localities, but places in the north or east will not give as many desirable additions to the average collection, nor furnish as many opportunities for studying local variations of species, as this will.

FLOATING STONES.

BY CHAS. H. STERNBERG.

I was much interested in Mr. Hanks' article on "Diatoms" in the November number of the REVIEW; especially the item on bricks that float. I once discovered a stratum of light-colored chalky clay stone, twenty feet thick, filled with the impressions of the dicotyledonous leaves, seeds and fish bones. I noticed that it was very light and, an object in the river attracting my attention, I threw a piece of the stone at it, and saw it float down the river.

Renewed experiments proved that there was no mistake; all the fragments, small or large, thrown into the river floated off like pieces of wood. Did not the ancients, perhaps, learn the art of making floating bricks from such deposits as I have described? This formation is on the John Day River, eastern Oregon, twenty miles below Cañon City.

The distinguished Russian geologist, Prof. G. de Helmersen, has prepared an elaborate report upon the coal fields of Russia, from which it appears that the annnal output of coal in the empire, though larger than it has ever been before, is estimated at only about 3,000,000 tons. The discovery, however, that the mines at Kamenskoe, which were only lately declared to be exhausted, are in fact the starting point of a vast region rich in coal veins and traversed by the Siberian Railway, is expected to produce very important results.

ARCHÆOLOGY.

ARCHÆOLOGICAL EXPLORATION OF THE MISSOURI RIVER.

In the early part of October, of the present year, the Kansas City *Times* inaugurated an archæological expedition down the Missouri River, the results of which have been published in nine articles contributed by Judge E. P. West to that paper, during the investigation. The Judge made the descent of the river from Kansas City to St. Louis in a skiff, examining the country adjacent to the stream on both sides. No research in this important field of investigation, heretofore undertaken in the State, has been so extended or so important in result as this one, if Judge West is correct in the facts detailed and the conclusions he draws from them. A brief summary of his work would not perhaps be uninteresting to the many readers of the REVIEW or an unimportant addition to the many interesting articles it has heretofore published on the subject. The Judge seems to have formed the opinion, pending the voyage, that different races which were hostile to each other occupied the different banks of the river and that their respective empires were widely extended. But the facts and the conclusions he draws from them will appear as detailed in this summary of them.

In considering the mounds and other antiquities on the south side of the river, Judge West says: "On a point at the intersection of the Missouri River and Blue River valleys, and overlooking them, stands a lone mound five miles east of Kansas City. This mound keeps vigil as a solitary and silent sentinel at the western empire which struggled through its part in human evolution and passed out of existence long before the European intruded his restless energy upon this continent.

"All the way down the Missouri River from this point to as far as I have yet examined (Miami, in Saline County), mounds precisely similar prevail. Rock Creek, Blue Mills, Sibley, Napoleon, Wellington, Lexington, Burlin, Dover, Waverly and Miami can all lay claim to mounds in their environments. They number by the hundreds, and stand on almost every high point on the south side of the river, or those at least commanding the finest views—silent witnesses of past empire and a lost race. They are very symmetrical in structure and vary in size from forty to sixty feet in diameter at the base and from six to ten feet in perpendicular height. No stone appears upon the surface, as in the chambered mounds on the north side of the river, and it is probable that no stone chamber is built in any of them; certainly there is none in those that have been opened. In fields where the mounds have been plowed over, fragments of pottery, flint chippings, and sometimes small burnt stones are thrown out by the plows.

Stone implements and broken pottery are found in the vicinity of all of them, especially in plowed fields, worn roads, and washes. Few of them have the appearance of having been opened or disturbed in any way. I ascended the bluffs in more than fifty places on my way down, and invariably found mounds; but in consequence of the almost incessant rains I was unable to open any of them west of this place. But for the past few days the weather has been more favorable for my work, and it is fortunate that the favorable weather conspires with a rich field for investigation. In the vicinity of Miami is one of the most interesting fields to the archæologist to be found in the State. In its vicinity events of the most thrilling interest occurred, associated with an extinct race, whose very existence would be unknown but for the silent monuments fashioned by it, and which it has left behind, of earth and stone, in the greatest profusion. Here, in addition to the mounds strewn all along the river above, there are other mounds of a different character."

After an elaborate description of the country about the Pinnacles, in the same article, Judge West continues: "The Backbone continues very narrow, indented with deep ravines on either side, back for the distance of about a mile, where it sends off a spur to the south and begins to widen and swells out into a very high and gently undulating plane stretching away for miles across the country. The spur, like the Backbone, terminates at the valley in a very sharp and abrupt point elevated some two hundred feet above it and is too steep for ascent. It continues very narrow back for about a quarter of a mile, where it widens out to two or three hundred feet, at the summit, and continues back about this width for another quarter of a mile, where it begins to widen and gradually widens back to its intersection with the Backbone, at a distance of about another half mile.

"On this spur, about a quarter of a mile back from its terminus on the river valley, stands a wonderful work, known as the "Old Fort." It consists of intrenchments thrown up on the verge of the summit of the ridge on both sides. The intrenchments are still from two to three feet deep, and are on either side one thousand one hundred feet in length measuring through the centre from end to end, and inclose an area from two hundred to three hundred feet wide, the trenches following the curvature of the summit of the ridge. At the sides there is but a single trench, but at each end there is a double defense closing the trenches except leaving a pass-way about fifteen feet wide. Near the centre of the work a single trench is thrown up connecting with the main trench on either side, with a pass-way in the centre of the same width as those at the ends. There are four small mounds in the works, which were opened last summer by Mr. Middleton, of Kansas City. Two of the mounds stand at the north entrance and to the right of the pass-way as you approach from the north, and two of them are near the centre cross intrenchments to the left of the pass-way as you approach from the same direction. Mr. Middleton found human bones, broken pottery, and flint chippings in the mounds. The bones were very much decayed. The pottery is precisely the same as that found in the fields in the vicinity. The trees growing in the intrenchments are of the same age as those in the adjacent forest.

I measured the stump of a white-oak which had grown in one of the trenches, but had been cut down several years ago. It measured three feet and a half in diameter two and a half feet above the roots. In other parts of the trenches, red-oaks more than three feet in diameter are still standing. There are three or four mounds near the intersection of the spur with the main ridge. From a half to three-quarters of a mile from the earthworks and on a line parallel with the west side, there begins an area of country extending to near the terrace before mentioned, a distance of about two miles and which is about the same width the other way. This entire area is literally covered over with low mounds, containing wood ashes, stone implements, pottery, mussel shells, and animal and human bones. Indeed the whole ground seems to be filled in this way.

"I dug into two of these mounds, in the field of Mr. Casebolt—they extend over four or five large farms—and for a depth of five feet I found successive layers of wood ashes and clay filled with broken pottery, flint chippings, bones and shells. The bones were those of birds and animals. But Mr. Casebolt, on the same farm, had a cellar dug under a part of his house after it was built, and in digging, at a depth of about three feet, two human skeletons were found side by side, buried extended in a horizontal position at full length. The bones were said to be very much decayed, and crumbled upon exposure to the atmosphere."

In his fourth article, in continuation of the antiquities at the Pinnacles and the history and tradition claimed by some to be associated with the "Old Fort," Judge West says: "The effort of the human race to attain a higher and better condition, is a matter of the deepest concern to all reflecting persons, and man's early struggle for good, in the race's infancy, are no less important than his efforts in a more advanced condition. In the grand problem of intellectual advancement every step is alike interesting and must stand upon a common level in the highest consideration of the great question. We find monuments of the humbler efforts of man, in his primitive condition, mingled with the work of the higher civilization of to-day, but they are fast fading away under its relentless incroachments. Each succeeding race, in its advance, destroys the work of the preceding races. As we are ruthlessly obliterating what has preceded us in human endeavor, so in the time to come, a grander enlightenment will still further make the forces of nature subservient to it and will efface the efforts of to-day with an equally relentless hand. But as our race has had its infancy, so too, it must have its time of decrepitude and old age, and in the grand mutations of time, pass from the world's evanescent stage.

"In my last article I promised a further account of the antiquities about Miami, and a notice of history and tradition attempted to be associated with the "Old Fort." The work of the race which forms so conspicuous a feature in the vicinity of the "Pinnacles," true to the law of the survival of the fittest, is rapidly passing away under the arts of civilization, and unless preserved by some friendly hand, will, ere long, be totally obliterated. Each succeeding year, as time moves on, the plowshare still continues to throw down its monuments. But to my promise. Those who associate history with the old fort, claim that it was constructed

by some of the early French or Spanish expeditions along the Missouri River. Some say it is Fort Orleans, construrted about 1720 by Captain De Bourgmont, who afterward, about 1725, assigned the command to his sergeant, Du Bois, who was made a captain. The history of this fort is somewhat romantic, owing to the marriage of DuBois to a princess of the tribe with whom the Spaniards were allied, and his subsequent massacre, with that of his entire command, not one being left to tell the sad story or the causes which lead to the tragedy. But the same history which tells this tragic tale contains facts which render it highly improbable that the earthworks at the Pinnacles could have been Fort Orleans. The expedition, according to the historic account, was undertaken in 1720 and only consisted of thirty men, and two officers. Five years after, the command was assigned to Captain Du Bois with no greater force at his disposal. The Spaniards were at peace with the neighboring tribes, and their ultimate destruction was not by an outside foe, but by the people with whom they were living on the most intimate terms. The fort is said to have been a stockade and was burned to the ground. The stockade was the most usual mode of defense against Indians of that day. There is no appearance of a stockade having existed about this old work at the Pinnacles. Thirty men would be wholly inadequate to the defense of more than 2,200 feet of intrenchments, and such a work was unnecessary for their Indian allies, as they were all friendly with the neighboring tribes. The trees in the intrenchments, which have grown up since the work was constructed, are certainly older than the date given for the Fort Orleans expedition. There is no water nearer than a quarter of a mile of the intrenchments, and, on the narrow ridge upon which they are constructed, water could not have been procured by digging under from one hundred to two hundred feet, and it is not likely that thirty men would undertake so extensive a work where the nearest water supply was more than a quarter of a mile distant, especially when there were numerous other places in the neighborhood more available for the defense of a small force.

"The tradition attempted to be associated with the work is still more romantic, and, if true, is stranger than fiction, and would unfold a chapter of heroic struggle unparalleled in the world's history. The tradition runs in this wise: That when Francisco Pizarro invaded Peru in 1531 a party of the native Peruvians, consisting of three hundred men, to save their church treasure and consecrated vessels from the sacrilegious hand of the Spaniard, took them under their care and proceeded north with their sacred trust. And after many encounters with the wild tribes along the line of march, and after many months of privation and hard travel, they finally reached a great river, which is claimed to have been the Missouri. Here they halted, but were surrounded by wild and hostile tribes. They erected a fort as a defense against their enemies, in which, it is said, they buried the vast treasure in their charge, and after a few years of painful struggle against their inferior but more numerous foe, were exterminated by their enemies. This tradition is based upon the story of a Portuguese and his buffalo robe. It is said that many years ago, when St. Louis was but little more than a village, a Portuguese, having in his possession a buffalo robe with historic picture writing

upon it, visited that place and spent several years there before revealing his mission. The strangeness of his conduct excited general notice and induced him, when he gave up the search, to impart the secret of his mission to one man. The remarkable feature about his conduct was that he made it his sole business to hunt out every Indian trader and trapper who visited St. Louis, and especially those from the Missouri River, and inquire of them for a certain country described by him and which, it is said, corresponds exactly with the Pinnacles and the mysterious "Old Fort." And in further confirmation of this tradition a vast amount of digging has been done at different times to find the buried treasure. But, so far, all efforts in this direction have been failures and until the treasure is found it would not be safe to attribute the work to this little band of heroes and martyrs to Spanish cupidity.

"By whom, then, was the work constructed? Evidently, by those who occupied its immediate environment when the work was done, the people who erected the mounds now standing in its vicinity. Everywhere around the in trenchment is evidence of a former dense population and a long continued occupancy of the country by a people capable of doing the work. No one who has studied the work and its immediate surroundings can doubt for a moment that it was the achievement of this people. The trees growing in the intrenchments, and which have sprung up since it was made, are evidently older than any known European expedition on the Missouri River, and perhaps were growing, some of them at least, when Columbus first rejoiced in the success of his discovery of a new continent.

"It will be remembered, too, that I stated there was an area of country more than two miles in extent each way, extending to near one end of the terrace and approaching to within a short distance of the "Old Fort," which is literally covered with low mounds. This district may very aptly be termed a city in ruins. The ground for a depth of from three to five feet, or more, is filled with the bones and domestic implements of a departed race, and for miles around their broken implements lie scattered everywhere. They were undoubtedly a people who had a fixed and permanent abode, and an agricultural people, to a limited extent at least, for some of their stone implements must have been made for the cultivation of the soil. They must have used their pottery vessels for cooking their food, and the low mounds represent their kitchens, in which wagon loads of broken vessels might be gathered up—broken at the domestic hearth.

"The intrenchment seems as old as some, at least, of the vestiges of this lost race, living around it; and all may be relegated to the same people, and to a time since, and not very remote from the close of the loess deposit, or to a time, at least, when but little if any vegetable mold was formed upon it, for their implements now found certainly rest upon the loess and underneath the black soil. A people with a fixed abode and who had made the advance toward civilization of those who erected the mounds and manufactured the pottery found in the environments of the "Old Fort" were capable of constructing such a work, and every thing points to them as the authors of it. And as it is manifestly older than

any known, or even probable, European expedition along the Missouri River we must assign it to prehistoric time and a prehistoric people.

"The State, or some scientific association of the State, ought to purchase th land upon which this mysterious, "Old Fort" is situated and preserve it as left b its builders. We should snatch one little spot from the hand of cupidity and th ravages of time and hold it sacred to the past and the memory of a lost race."

For fear of drawing too heavily upon your space in the present number, will ask to continue this summary in your next one.

PALÆOLITHIC.

KANSAS CITY, December 15th, 1881.

DR. EDWARD PALMER'S RESEARCHES IN MEXICO.

Mr. Putnam said that it gave him great pleasure to call attention to the in portant work which Dr. Edward Palmer had done in Mexico, while acting und his direction for the Peabody Museum of Archæology at Cambridge. Dr. Palı er had recently returned from the southwestern portion of Coahuila where he h been, notwithstanding many difficulties, very successful in exploring sever caves that long ago were used as burial places by the Indians of that regio These burial caves have been mentioned by a few writers, and stories have be told, by people who visited them or heard of them, nearly half a century ago, the immense number of human bodies that they contained. Since then t caves have been, unfortunately, pretty thoroughly worked over for nitre, and is said that thousands of the "mummies," as the bundles of human bones a called, were used for fuel by the nitre workers. Dr. Palmer, however, after co siderable search in several caves, had found in their deep recesses a number the bundles that had not been disturbed and these he had brought to Cambrid where they had been carefully opened and their contents and wrappings arrang in such a way as to keep all belonging to a bundle together. Each bundle, it w found, contained the bones of one or more human skeletons and various obje such as ornaments, implements, small baskets, sandals, and articles of clothi The great resemblances of these "mummies" with those found in the caves Kentucky and Tennessee is of particular interest. Mr. Putnam stated that considered the collection one of great interest and that a detailed account of would be given, in which Dr. Palmer's notes would be incorporated.

Dr. Palmer then exhibited a small portion of the collection, including number of pieces of cloth which were beautifully woven from agave fibre, a cords and bands made of the same fibre, baskets which were probably used food vessels, large stone knives that were fastened to short handles of wood, s and bone beads, a necklace made by stringing the vertebræ of a snake on sev pieces of soft cord, portions of a fringed skirt, on the edge of which feathers been fastened, a feather head-dress, braided sandals, and many other interes objects which were found in the bundles. Some of the pieces of woven c

were eight to ten feet in length and about four feet in width, and were not only finely and evenly woven, but were also of several different colored patterns. While explaining the different specimens, Dr. Palmer made many interesting remarks upon Indian life of the present time, and compared some of the ancient remains from the caves with similar things used by the present Indians. Many of the things, however, which were found in the bundles were not like those used by the Indians of the present time, and from this fact and from the few inches of cave breccia which had formed over the human remains, and contained thousands of bones of bats and small rodents, Dr. Palmer thought there could be no doubt as to the bodies having been placed in the caves long before the Spanish conquest of the country, and he stated that not a thing derived from the Europeans had been found in the bundles, nor, so far as he could learn, in any of the burial caves.—*Proceedings Boston Society of Natural History.*

ON THE MOUND-BUILDERS' KNOWLEDGE OF METALS.

BY WM. H. R. LYKINS.

I notice that Prof. Reid is being criticised for the statement made in his article in the November number of the REVIEW, that a fragment of a mound-builders' axe found by him had been molded. Now, while it is hardly to be supposed that the Indians or "Mound-Builders" had attained such a knowledge of metallurgy as to mold their implements and ornaments of copper, yet it is not so improbable as it may at first seem. A lump of melted metal, or even soft clay, falling into an indentation or cavity would take the form of that indentation, and from such a simple occurrence the Indian or "Mound-Builder" might conceive the idea of molding in a rude way his hatchets and other implements. Many years ago, when residing among the Indians of Kansas, I remember to have seen the young men make small ornaments by cutting figures in wood and filling them with melted pewter or lead, using a *wooden* ladle in which to melt the metal. A bowl-shaped cavity, with a lip or channel on one side, was cut in a very green piece of wood; the metal broken up and placed in the cavity, and a fire of hot coals placed upon top of the ladle, instead of under. In this rude and primitive way very passable figures of turtles, birds, horses, etc., were made. I have also seen handles of tomahawks and war-clubs very handsomely ornamented with geometrical figures in silver, in the same way using their old worn-out ornaments of silver for that purpose. But whether the idea of molding was original with them or whether they had learned it from the whites, I never thought at that time to inquire. The question is one of some interest to archæologists, and no one can yet say positively whether the Mound-Builders did, or did not, use molds, until further investigation has thrown more light upon the subject. Yet it does not seem improbable that a people who had become so proficient in the art of

making pottery as their remains show, should not have acquired some knowledge of molding.

The great difficulty in the way of their attaining and using such knowledge was the paucity of metals with which they seem to have been acquainted, native copper, which is easily worked in its natural state, being the only one. It is more surprising that they never discovered the use of lead—a metal so easily reduced and manipulated, and found in so many places throughout our country. Even a fierce forest fire of fallen timber burning on an exposed vein of Galena would reduce some of it to a malleable state, and thus attract their attention; but so far as we know few if any implements or ornaments made of this metal have been found among the Mound-Builders' relics.

ENGINEERING.

THE MISSISSIPPI LEVEES—HOW BUILT AND HOW REPAIRED.

Above the confluence with the Ohio the Mississippi Valley has more of the commonly accepted conformation of a valley, the land sloping on both sides toward the river, forming a basin. But from the Ohio downward one has to go miles away from the river before reaching the sides of the valley, there being many thousands of square miles of land which are of an almost floor-like level, only sloping gently southward toward the gulf. Over this floor the river has, with its sediment, built itself a great roof-shaped ridge, and along the ridge-pole of this roof, so to speak, the greatest stream in the world pursues its crooked course. As water seeks the lowest level, of course when the river is high the tendency is to "slop over" and flood vast regions of the river lands on either side. Were it not for this elevated position of the Mississippi, the damage wrought by the floods would be comparatively local in extent, but, as it is, between 32,000 and 37,000 square miles of alluvial territory are liable to inundation when not protected. Scientists tell us that within comparatively recent times, geographically considered, but still long before the discovery of America, this vast alluvial ridge, together with the delta, did not exist, and the "Father of Waters" ran, a clear, limpid stream, from its source to the Gulf. But by some change in the surface-covering of the country—probably the destruction of the trees throughout the vast plains of the valley by the aboriginal inhabitants, converting them into open prairies—the land was exposed to the attacks of the waters, and the Mississippi was made a turbid stream, carrying each year hundreds of acres in a liquid form, either to be superimposed upon the level lands along its course, or to be built out into the Gulf, the fresh-water invader thus conquering new areas of land from the salt sea.

To protect the valuable lands along the exposed part of the river gigantic systems of levees have been made necessary, forming a length, on one side or the other, of about 1,800 miles, and representing in first cost and present value $20,000,000. But even the present system is regarded as entirely inadequate, for the levees, which are constantly breaking or threatening to break, protect but a comparatively small strip along the main stream and its principal tributaries, whereas by protection against overflow, and by proper drainage, an enormous expanse of what is now waste swamp land would be brought into cultivation—a stretch of country beside which the areas reclaimed from the sea in the Netherlands sink into insignificance—while the work of reclamation, gigantic as it would have to be in relation to its results, in the amount of time and labor required, would be comparatively small beside the work of the industrious Dutch. There would thus be rendered available along the Mississippi not less than 2,500,000 acres of sugar land, about 7,000,000 acres of cotton land, and 1,000,000 acres of corn land, all of unsurpassed fertility. On the eastern side of the river is the great swamp of Mississippi, fifty miles wide, extending from just below Memphis to Vicksburg, 170 miles in a direct line and nearly 400 miles along the river. On the other side is another vast and fertile region, embracing the lower part of Missouri, all the alluvial front of Arkansas and of Louisiana as far down as the mouth of the Red River. This land is not so favorably situated for reclamation as that on the eastern side, where there is no tributary of the Mississippi until the Yazoo is reached, within a few miles of the Walnut hills, near Vicksburg. But on the west side are a number of tributary streams, themselves all liable to overflow, while all are subject to back-water from the Mississippi, which would make levees necessary as far as the line of back-water extends. Much fine land, however, has been reclaimed here, although the line of levees is more fragmentary than on the other side. Below the Red River there are no tributaries entering the Mississippi, and on the other hand the waters are depleted by numerous outlets to the Gulf.

The levee system of the Mississippi in its beginnings is comparatively ancient, having been started in Louisiana in the early part of the last century. But in Mississippi and Arkansas the reclamation of the swamps is of modern date, having originated almost within the memory of living persons, and having been at first the work of individuals, unassisted by the State, which, from an early period, assumed the control of the matter in Louisiana. The first plantations on the Mississippi, between Memphis and Vicksburg, were established upon knolls, which, although the product of the floods themselves, gained the reputation of being "above overflow," because they had not been submerged for a number of years. Being very rich, they came into great favor as cotton plantations. But finally unusually high water came and dispelled the delusion about their security. Once in possession, however, the planters were naturally reluctant to abandon such rich lands, and means were devised to keep out the water. Water marks left upon the trees and other objects indicated the highest points the water had ever reached and supplied the place of engineering knowledge in telling how high to

build the levees. Makeshift levees of primitive style were thrown up close to the river bank in order to save the land for cultivation, and also because the ground was always highest upon the river margin. As the plantations became more numerous, and approached each other, co-operation came into play, and levees were built for a long distance across the river front of several plantations. The levees thus built were of slight construction, but they afforded ample protection for a number of years. But in 1844 the river rose unusually high, and all the levees were destroyed, making it evident that more substantial methods of construction must be introduced. State aid was called in for the first time. Levee Boards and other similar bodies were organized; funds were raised by local taxation of lands; professional engineers were consulted and employed, and, the negroes not being skilled with the spade, armies of Irish laborers were drawn into the service.

Much of the work was necessarily temporary, the unbridled river carrying away huge slices of its banks in the most unexpected places. Therefore it was necessary either to renew the levees frequently or place them far back from the river, and out of its reach if possible. But this made the land in front worthless for cultivation, and violent controversies were thus brought about between planters and the Levee Board, the former naturally objecting to being deprived of so much of their best land.

The primitive levee, as built before the days of civil engineers and Irishmen, was an embankment sloping from the surface at an angle of forty-five degrees to a foot or two above high-water mark. Ground was thrown up from each side, making an irregular ditch at each base, two spades deep, and usually full of water. Whenever the river rose against the levee, the "transpiration water" which oozed through and filled the trench behind, made it difficult to get at levee for work in case of emergency. The levee was directly upon the natural surface, stumps and even logs were left in it, leaving places where dangerous cavities for the passage of the insinuating water were certain to form. Sometimes the levee, built directly upon the surface, would slide away from the pressure of of the river.

The improved mode which followed was, first, to clear the space to be covered by the levee entirely off, removing trees, stumps, roots, logs, weeds, and even grass and leaves. A so-called "mock-ditch" was then dug the whole length of the proposed work, three feet wide and of the same depth. This was straightway filled up again. The object of this was to close all root holes and to mortise the superstructure into the natural earth, thus preventing any sliding away. The loose earth thrown up for the building of the levee, and filling the ditch in settling, naturally formed a uniform mass more solid than the natural earth. The levee, by this construction fitting into the ground as two matched boards fit together, was thus securely anchored. In building the levee according to the improved method the material is only taken from the ground outside, toward the river, and at least twenty feet away. The earth is carried on wheel-barrows upon run plank. The dimensions vary according to the

available funds. But it is a rule to make the top three feet perpendicular above high-water mark, to top level, and as broad as the levee is high. The height, of course, varies according to the level of the natural bank above the river. The last step in the process of construction is the "seep-water ditch," dug something like thirty or forty feet from the inner margin of the levee, and, running parallel to it. This is to carry off the water oozing through even the most compact of levees. From this ditch the water is conducted off to the swamp in the rear. As a finishing touch the levee is planted with Bermuda grass, which in a short time will cover it with a dense sod and add greatly to its strength, enabling it to resist the abrasion of the water. The season for building lasts from October through the winter until the spring rise puts a stop to the work. The laborers are collected by contractors in St. Louis, Cincinnati and other up-river towns, and are chiefly Irish, with a few other nationalities mixed in. When the season closes, all except a few return to the upper country. The work is paid for by the cubic yard, usually from 25 cents to 35 cents a yard. The cost varies with the dimensions, a good seven-foot levee with ample base costing from $8,000 to $11,000 a mile, the higher costing in a much greater proportion and the lower in much less.

The season of the highest water, which is that of the greatest peril to the levees, is variable, and ranges from April 1st to July 1st, sometimes coming earlier and sometimes later. It depends greatly upon the winter in the upper regions; a mild winter brings an early flood, while a hard winter delays it by keeping the rivers above closed with ice. The most dangerous floods come from the Ohio and its branches. The Upper Mississippi and Missouri have not nearly such a power for evil. This has reference to the effect upon the Lower Mississippi. The recent October floods that have wrought such damage were upon the Upper Mississippi and its tributaries, above the region of the levees.

The breaks of crevasses are rendered more easy of repair as they increase in width. This diminishes the force of the water, and when it falls below the strength of the material forming the levee the abrasion ceases. Sometimes the destructive work is limited through securing the ends of the levee by driving down heavy stakes and depositing masses of gunny-bags filled with earth. Sometimes a thicket of willows or other trees, or even a chance log, masking the critical point, accomplishes the same result. The closing of a crevice becomes practicable when the river has so fallen, or the overflow water within has so risen, as to diminish the current to allow the driving of a line of stakes across the break. With the diminishing width the greater becomes the difficulty. A crevasse closed in time, and with comparatively slight expense, will often save hundreds of thousands of dollars worth of property. Gunny-bags are the best things to stop a crevasse; they are rather costly, but it pays to have them on hand. Other materials for stopping a breach are stakes, boards, brush and earth, the latter both in bags and loose.

The damage caused by an overflow consists chiefly in the loss of time and the injury to the crop prospects, for it is, of course, impossible to plant until the land has been drained of the water. Cattle are often drowned in large numbers, but buildings are rarely injured, for the water of the overflow is generally currentless. It is rarely that a break occurs directly in front of buildings. Breaks are often occasioned by the borings of crawfish, which honey-comb the levee and let the water through. Another danger is an exposed position to a long sweep of the wind down the river for several miles, dashing the water against the levee with great fury. The first land to suffer from a break is that farthest away from the river, down toward which the water flows. If there is no outlet down the valley for the water it will gradually back up toward the river, filling all the space with a great pond. The land close to the levee, being the highest, is the last to suffer.

The greatest flood ever known on the Mississippi was that of 1844, which swept away all levees, overflowed the entire country, filled up the swamps, remained at high-water mark for months, until the middle of July, and did not finally retire until nearly the middle of August. The flood was owing to the unscientific construction of the levees, and would be hardly possible since. William L. Murtree, Sr., gives a graphic description of the flood in *Scribner's* for July: "The shallowest water, for indefinite miles in any direction, was two feet deep, the nearest land 'the hills of the Arkansaw,' thirty miles away. The mules were quartered on the upper floor of the gin-house; the cattle had all been drowned long ago; planter, negro and overseer were confined to their respective domiciles; the grist-mill was under water, and there was no means of preparing corn for culinary purposes except a wooden hominy mortar. That year nineteen plantations out of twenty failed to produce a single pound of cotton or a single bushel of corn, and, when the flood was over, and the swamp Noahs came out of their respective arks, they were, to say the least, malcontent."

There had not been such a great rise since 1828, but that did comparatively little damage, for the country was then hardly inhabited. Since that time there has been no such universal damage, for the levees have not succumbed all together at any subsequent period of high water. But the injury, although scattered here and there is very great, for the country is now more thickly settled and productive. Millions of dollars worth of damage is annually done by floods in various parts of the Mississippi Valley. In 1871, in the Ouachita Valley alone, one of the tributary streams in Louisiana, the damage by a flood was $5,000,000. The flood of 1874 caused a loss of $13,000,000.

It is now proposed that the Government take the improvements of the Mississippi in charge and carry out comprehensive measures designed to prevent further floods. It is urged that this is a national matter, as the reclamation of such a vast area of the richest land would add immensely to the prosperity of the entire country. This area is as large as the States of New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut and New Jersey combined. Less than eight per cent of this area is now under cultivation. It is estimated that,

protected and improved, these lands would be worth $2,043,858,251. As their present value is but $107,628,833, the increase would be a sum nearly equal to the national debt. It is therefore claimed that the returns would justify the outlay of the largest sum which the improvement would be likely to cost.

In 1874 a national commission recommended an elaborate levee system. As this was regarded as but a temporary expedient, the commission appointed under the law of 1879 considered more comprehensive plans. Chief of these are two which are designed to make a subordinate element of the levees, and possibly to make it possible to dispense with them altogether. One of these is called the "outlet system," and is designed to carry off the superfluous waters by making large and adequate outlets, possibly diverting the Red River so that it shall reach the gulf independently of the Mississippi.

The system recommended by Capt. Eads, who has the prestige of success, never having failed in anything he has undertaken, is the precise opposite, as he proposes to close all outlets, confining the water so closely that it would dredge out the channel, giving a uniform width, depth and velocity. He claims to be able to secure a channel twenty feet deep by this means, thus improving the navigation wonderfully and preventing all danger of floods. These benefits can be secured, he says, "for a sum entirely within the ability of the Government, and one really insignificant when compared with the magnitude of the benefits which would flow from such improvements."

The New York *Journal of Commerce*, in commenting upon the recent floods in the Upper Mississippi, commends the sentiments of a correspondent, who fears injury to the dwellers along the upper part of the stream by the proposed improvements below. The *Journal of Commerce* says art can not interfere for the most beneficent purposes with the natural channel or course of a stream without producing results different in some respects from those intended. Mr. Eads' jetty system of narrowing and deepening the Mississippi at points below New Orleans has not been in operation long enough to effect the injurious consequences which may yet be expected from it on the waters far above. But, if this plan is carried out on the enormous scale demanded by the St. Louis Convention, in parts of the river remote from its mouth, then the floods of the future cannot fail to be more serious than those of which complaints are now pouring in from the West. If the present unrestricted channel of the Mississippi is not wide enough to accommodate the waters of the freshet, it "stands to reason" that every dike, jetty and dam constructed for the purpose of narrowing the river must offer a diminished outlet for the superabundant water. There are others, however, who say that such objections as these have about as much weight as that of the wolf who said that the lamb drinking in the stream below him was defiling the water where he was—*Boston Herald.*

SOME GREAT ENGINEERING PROJECTS.

The shortening of commercial routes by means of ship-railways and ship-canals seems to be the great ambition of the engineers of to-day.

In addition to the De Lesseps Ship-Canal at Panama, the Eads Ship-Railway at Tehuantepec, the Florida Ship-Canal, the Chesapeake and Delaware Ship-Canal, the Cape Cod Canal, and others in the interior of this country, there are several other important projects of like nature under way or in prospect in various parts of the world. The old project of connecting the Bay of Fundy and Baie Verte, on the Gulf of St. Lawrence, across the Isthmus of Chignecto, has lately taken new form. It is now proposed to make the connection by a ship-railway eighteen miles long, thus making a short-cut for navigation between the United States and the ports on the St. Lawrence Gulf and River, and saving the long and dangerous voyage around Nova Scotia.

The projector of the ship-railway, Mr. H. G. C. Ketchum, writes us that the plan grew out of a desire to save lockage and a deep channel in the design of the Baie Verte Canal. His first plan was to lift vessels by hydraulic power on pontoons and then float them through the canal. The idea then occurred that they might as well be lifted to the surface of the ground and hauled across the neck of land on rails. The road may be level and perfectly straight from end to end. The plan has been submitted to the Dominion Government and is favorably entertained. Mr. Ketchum has issued an interesting pamphlet relative to the project, which may be considered at greater length elsewhere.

Across the ocean the construction of the tunnel under the British Channel, connecting England with the Continent, is being prosecuted with an energy which is indicative of ultimate success, and thus far no obstacles have been encountered to make the undertaking a difficult or exceptionally hazardous one.

In France, the connection of the Atlantic with the Mediterranean by a ship-canal, to save the long and stormy voyage around the Spanish Peninsula, is under serious consideration, and the Council-General of the Seine have just adopted a resolution approving of the project.

The ship-canal across the Isthmus of Corinth, in Greece, to shorten the route to Constantinople and the ports of the Black Sea, has, we believe, been definitely determined upon.

In the far East a bolder and more important project is in contemplation, with a view to shortening the commercial route to China and Japan by six hundred miles or more. At the head of the Malay Peninsula is the Isthmus of Kraw, connecting Upper with Lower Siam; and by the cutting of a ship-canal at this point, about thirty miles in length, the need of sailing around the peninsula might be obviated. At Kraw, the Malayan Peninsula, which stretches southward for five hundred miles to Singapore, is at its narrowest breadth, and the distance across from the side of the Indian Ocean to that of the China Seas is further decreased by the existence of natural water-ways for some distance inland

from both shores. From side to side it is no more than fifty miles, and the Pakchan River, on the western coast, and the Htassay on the eastern, afford the ready means of further reducing it. The distance, therefore, over which it would be necessary to cut a canal would probably not exceed thirty miles. The neighboring districts are known to be fertile and to contain great mineral wealth. A tin mining company has been established for more than ten years at Malewon, on the Pakchan, and gold has been found in the neighboring stream of the Lenya. So far as known the engineering difficulties are not of a stupendous character, and political drawbacks and considerations fortunately do not exist.

The French appear to have taken the lead in proposing this important commercial short-cut, and, if the opinion of the London *Times* is well founded, the Government of British India will not decline to actively participate in its execution.—*Scientific American.*

THE NEW TAY BRIDGE.

Plans for the new Tay bridge are now on exhibition in Edinburgh for inspection by intending contractors. The new bridge is to be built on the girder principle, four brick arches next the shore on the south side, each having a span of 50 feet; the girder work commencing with a span of 118 feet from centre to centre of the piers, is continued with ten spans of 129 feet and thirteen spans of 145 feet; this reaches the navigable portion of the channel. Here are eleven spans of 245 feet and two spans of 227 feet; the first four of these spans are 77 feet above high-water mark. From this point the bridge falls at a gradient of one in 114, there being one span of 162 feet, ten of 129 feet and six inches and one of 127 feet and six inches. The bridge is to be constructed for a double line of rails; foundation will be formed of wrought-iron cylinders filled with concrete, with brick-work eight feet above high-water mark. Two piers are then formed of wrought-iron pillars braced together, connected with each other near the top; the platform of the bridge is of wrought-iron.

UNDER-GROUND CABLES.

The telegraph pole and wire nuisance which prevails in all cities will probably soon be abated to a great extent. In New York and Chicago the wires are rapidly being put under-ground, and it is possible that the time is coming when the under-ground method of telegraphing will be in vogue all over the country, as it is now pretty generally in Germany. In Chicago four miles of this cable have been laid and the work is being pushed as fast as possible. Under-ground telegraphing has been a problem difficult to solve, and it is only recently that it has been brought to anything like perfection. The method in use at Chicago consists, in brief, of a cable made up of No. 12 copper wire, inclosed in a lead pipe, resting on a cov-

ered pine trough, and sunk into a trench three feet deep. The preparation of the cable is thus detailed: Each wire is first run through a glass tube an eighth of an inch in diameter. Twenty of these wires, each incased in its glass tube, are inserted in a lead pipe. One end of the latter is then tightly closed by slipping over it an air-tight "cap." A small opening is cut into the upper surface of the pipe, and the cut piece of lead turned back. It now remains to make the tube thoroughly air-tight and completely insulate the copper wires, and the way it is done is as unique as it is interesting. A hot solution of resin, tallow, bees-wax, and other insulating compounds is poured into the pipe at its open end. As the hot solution flows through the pipe it drives the air before it, and takes the place formerly occupied by the atmospheric fluid. The air, unable to find an exit at the closed end of the pipe, is forced up through the small opening cut in its upper surface. The solution continues to be poured in until the air is finally entirely expelled, when the lead cutting on the upper surface is thrown back into place, filling up the opening, and an exterior application of solder prevents the entrance of any air from the outside. The result is an air-tight lead pipe, filled with copper wire incased in glass tubes, and the whole arrangement is thoroughly insulated by the solution of hot resin, bees-wax, tallow, etc. The ends of the copper wires, however, are allowed to extend several inches beyond the lead pipe, in order, of course, that two connecting pipes, with insulated wires, may be properly joined together, and the line drawn out by the union of its several sections. The process of making this wire in every detail is interesting, and involves great care and nicety of execution, but when completed, turns out a pipe full of thoroughly insulated wires, and renders a break in the electric current impossible. The manufacturers of this wire are said to be crowded with orders, showing that the telegraph companies contemplate putting it into use at once in the cities, where the removal of the unsightly poles and wires is very desirable.—*Kansas City Journal.*

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, Nov. 22, 1881.

M. Pasteur's discovery for vaccinating live stock as a preservative against the *charbon* malady, has naturally awakened inquiry as to extending the application of the principle. Now, two distinct diseases are confounded under the same appellation of *charbon*, which, while having certain points of external similarity, differ widely fundamentally. In the case of the *charbon* fever, the disease was inoculable by the blood, while in the second, symptomatic *charbon*, it was the contrary. Both maladies have their origin in the animalcule of the microbe

family, but there is a difference in the species. When inoculation, for example, takes place with the microbe derived from the *charbon* symptomatic, a large tumor is formed, and carbonic acid generated in the interstices of the tissue—hence the tension and sonority of the tumor when struck; there is, however, nothing putrid, for when the tumor is opened only the gas mentioned escapes. Hence, there is an affinity between contagious fermentations and those that take place external to living bodies. A second difference between fever *charbon*, which produces hardly any tumor after inoculation, and the symptomatic is, that in the former, when the microbe is introduced into the blood, fever is rapidly induced, ending in a short time fatally. In the latter, the microbe produces but a moderate and ephemeral fever, never fatal, but not the less so profoundly affecting the system as to protect the animal against death, as the injection into the veins of animalcule confers immunity on the beast. Professors Arloing and Cornevin have identified their names with the method of inoculation for the symptomatic dissease, and which preserves the animal from the contagion; their experiments have taken place in public, and with uniform success; stock vaccinated lived; stock non-inoculated, died. M. Pasteur's method consists in specially preparing the virus or pock by artificial means; the Professors take the virus in its natural state, and inject it directly into the veins—it becomes mortal if introduced into the tissues—the blood thus forming the medium for changing the virus into a vaccine; that is where their process differs from Pasteur's, and which is tantamount to a real discovery. Professors Arloing and Cornevin are also of opinion, that a cow inoculated during the early stages of gestation, can confer immunity on the offspring. Often an animal not inoculated, but living with animals that have been, escapes contagion; this is presumed to be due to spontaneous vaccination. Farmers having asserted, that cattle when over three years old escape the symptomac *charbon* disease, the Professors tested the tradition by experiment and found it to be correct.

Is there any antidote against the venom of serpents? Up to the present caustic potash was considered an efficacious remedy. According to M. de Quatrefages, M. de Lacerdo, of Rio Janeiro, finds permanganate of potash absolutely a perfect antidote. Dogs, into whose tissue or veins, the virus of serpent poison had been introduced, died more or less rapidly; but others invariably lived if dosed with permanganate. This would appear to corroborate the views of M. Pasteur, viz: the oxidation of venom modifies its toxical qualities. It is to be hoped the experiments will be pushed to find an antidote against rabic virus.

Game, birds especially, possess a flesh very appetizing, fine and energetically reparative, which is easy to digest, and suits well-debilitated stomachs; the same cannot be said of venison, wild boar, etc. though possessing savory flesh, they are exciting and heating. Game provokes the stomach to energetic action, inducing the coats to secrete abundantly; it remains longer too in the stomach, is more completely acted upon by the economy of digestion, and is largely assimilated by the system, enriching the blood, and imparting stimulus and life to the organs. However, a regimen composed exclusively of game, would ultimately prove as

detrimental to health as one solely limited to fish: constipation, headache, congestions would ensue. Besides, of all flesh aliments, game is what soonest fatigues the stomach. Formerly pheasants were much employed for invalids, but then such ought to be young and tender; eaten too soon, the flesh is hard and leathery; eaten too late, it is indigestible. When doctors recommend pheasant to convalescents, it ought to be served roasted and a little ripe; however, stomachs even those *sans peur et sans reproche*, as well as those less robust, ought to even remain on guard against a meat when in a state of decomposition. Partridge is the best of all game, either for the healthy or the indisposed, in point of alimentation; its flesh is easily digested, and it demands not to be "hung" to become agreeable; the red is preferable to the grey partridge; for the sick nothing can be superior to an old partridge converted into broth; although boiled and served with cabbage being the favorite form in which partridge is served, on the continent at least, yet it should be roasted for convalescents. In ancient times quails were said to produce epilepsy; at least Pliny, who ever had a weakness for the marvelous, and introduced a good deal of romance into natural history, prohibited the eating of that bird, because it fed on venomous plants, and, hence, was subject to epilepsy. The flesh of the quail about harvest time is very delicate and savory; its fat being difficult of digestion, causes it to be less in favor for invalids than the partridge. Woodcock is ranked by sportsmen above partridges, when young and fat, its flesh is very savory and of delicious taste, but as it requires to be hung, to develop its qualities, it is thus excluded from regimens for the sick. Brillat-Savarin has asserted, a woodcock should be ever roasted under the eyes of a sportsman, and above all, the sportsman who brought it down. Ordinarily it is so richly cooked as to recall the old adage: "we live, not by what we eat but by what we digest." Snipe is preferred by not a few to woodcock, as being more delicate; after the first frosts, it is an exquisite table bird; its flesh is digested readily, and not requiring keeping, like all water-fowl, it suits well the sick; if abused, snipe would prove an exciting food. Wild duck possesses a peculiarly fine taste, and is very superior to its domestic namesake, which is absolutely unsuited for the gastralgic and the dyspeptic; yet with all its advantages, wild duck should be avoided by convalescents. The Romans held peculiar views about ducks, partaking only of the head and breast, the remainder being, according to Martial, destined for the cook's perquisites. The best form in which to eat wild duck, is that of the *pâte d' Amiens*.

Boulogne-sur-Mer it seems, was a shade too hasty in perpetuating, in the form of a statue, the claims of Frederic Sauvage, as the inventor of the screw-propeller. Professor Govi, of Naples, has irrefutably shown, the honor reverts to Leonard di Vinci, who in the fifteenth century applied the screw to propel light paper machines in the air; it was a hobby with the great painter to discover the means to fly, and he wrote some remarkable articles on bird-flying; he even contemplated an apparatus destined to enable man to mount into space. Drawings

of di Vinci's screw-propeller exist in the National Library of Paris, as also those of his machines for aërial navigation.

The Congress of electricians in its twenty days sittings, has done good work by adopting unity of views and correlating common results. Science will gain the first by this homogeneity, and next the public. It has unified the standard of electric measures, so as to express in a uniform manner, and according to the decimal system, the force, the intensity or volume, and the resistance of an electric current. M. Denayrouse made a warm appeal to the partisans of electricity to unite to secure the full benefits of electric discoveries. The obstacles to the practical extension of these benefits, are statesmen and municipal councils, aided by no less than twenty different inventors, each claiming the pre-eminence for his own system. Were these social impediments conquered, there would be no difficulty in transmitting electric energy like gas, and transform it into light and mechanical power, and so enable workmen to toil, not in a factory, but in the bosom of his family. M. Siemens executed a most brilliant experiment; he arranged a crucible in a certain position, placed therein fragments of steel, placing over same the perforated cover; the two currents furnished by an electro-motor wired, one at the top the other at the underneath, part of the crucible; in fourteen minutes the mass of steel became red hot and melted, and the quantity of fuel expended to work the electro-generator was less than what would be necessary to secure fusion by the direct application of heat. The mass of metal as melted by M. Siemens, presented no blisters.

Attention remains unabated relative to the subjects of electric domestic lamps, and I might add, domestic and portable electric motors; the latter appears to be but a question of cost, the former but of choice. The Maxim lamp has undoubtedly become a favorite with the public; it is economical and *moderateur;* its light is intense, yet as soft and as supportable as that of gas, while possessing more regularity and fixedness. Mr. Maxim's generating machine by the length of one horizontal ring, enables mixed illumination to be obtained, that is, to utilize the variety of the current for the incandescence and the other for the voltaic arc. The Weston generating machine also deserves praise for the excellent uniformity with which it generates electric currents for lighting purposes. At the Grand Opera the government instituted a series of experiments to test the several systems of illumination versus gas; the arrangements were incomplete, so the result is undecided. It was at two of these experimental representations that the Maxim lamp won so many honors.

PHILOSOPHY.

PRAYER FOR PHYSICAL HEALING.

BY S. H. TROWBRIDGE.

Was anything gained by praying for the restoration of President Garfield? Did not the disabilities resulting from the assassin's bullet, work out their results in accordance with the laws of nature, and are not these laws immutable? "Can a man take fire into his bosom, and his clothes not be burned?" "Can one go upon hot coals, and his feet not be burned?" Can one violate the laws of his being and not suffer the legitimate consequences of his acts? "Whatsoever a man soweth, that must he not also reap?"

God works by law in nature and in grace. He has ordained the laws of nature as his own plan of controlling the material universe. We are satisfied that he conforms strictly to these laws in all the physical phenomena which our minds have, as yet, been able fully to understand. To more and more of these do we find him thus to conform as science advances. Many events, which were once looked upon as miraculous, are now explained in this way to the satisfaction alike of friends and foes of the Bible. Some events recorded in Scripture that we are accustomed to consider genuine miracles, are accompanied in the record itself with a statement of the physical causes which are there distinctly said to have produced them. Elijah is said to have been carried up from the earth in a whirlwind. And travelers tell us that severe whirlwinds, capable of carrying up heavy bodies, often occur on the banks of the Jordan; caused by a severe gale as it sweeps over the abrupt bluffs. The waters of the Red Sea, as we are told in the Bible, were parted for the crossing of the Israelites by means of a "strong east wind" that blew "all that night." And if it is true, as surveyors of the Suez Canal route assert, that a bar or upheaved crest, a little beneath the water's surface, marked their line of march across the sea, the friction of a strong wind would be sufficient to blow the water away and leave dry land for the passage of the hosts of Israel.

Clay, which is known to possess healing properties, was used by Christ in opening the eyes of the blind man. I know that this and washing in the pool of Siloam are said to be only helps to his faith; but what harm is there in the supposition that Christ knew of the healing properties in the clay, and availed himself of them? Much has been said, of late, about "faith cures," and, in many cases, the proximate cause has been traced to the mere effect of the mind on the body, or to the "expectant attention" of the patient to some supposed effective remedy. And it is claimed that it makes no difference what the remedy is, or

owever inefficacious in itself. A thermometer in the mouth of a patient has een mistaken for some wonderful means of restoration and has effected a complete ure. Have not bread pills often done the same? And is it not true that the nind has more influence over the body than medicine? There is abundant evilence to prove this. Yet, in all such cases of cure, there is the inscrutable conection of the mind with the body which is not known to conform to natural aw, and doubtless can never be traced to its action. But the supposition is reaonable that they do conform to law, but in higher phases of it than we are now ble to comprehend.

Miracles are, doubtless, as much in the order of nature as the germination of seed or the budding of a flower, and these are miracles. Dr. Cocker has well aid: "The devout feel that wherever God's hand is *there* is miracle, and it is imply an undevoutness which imagines that only where miracle is can there be ıe hand of God." Yet, it is well to observe the fact that the cure is due to some eculiar state of mind in the patient, does not at all *prove* that it is any *more* the esult of natural law, or any *less* the influence of the Power superior to matter nd its laws. The confessed fact that it is inscrutable to man gives sufficient titude for the entrance of the power of Divine will, and makes this the most easonable supposition.

Now *if* we should ever *fully know* that faith cures, and also the dreams and sions of patriarchs and prophets, or presentiments and the like, of devout people the present day, were caused by some thoughts or images of waking moments, ere they not brought about by Divine agency, and just as legitimately revelaons from God as if not in the order of nature? And *if* men should ever learn, closer and deeper study of God's laws and of his word, that some or all of hrist's physical works which we now call miracles were strictly conformable to ature's laws which we *can* understand, would not the works have accomplished eir purpose just as effectually? Should we lower God to our level, or detract in e least from his greatness and his goodness? Should we not rather thus, by Dine help, raise ourselves toward God in his own appointed way? And God in ırist is the model of excellence toward which we should constantly struggle. ıis discovery would only bring the Christian and the scientist closer together in eir belief. The design of the Creator in benefiting the creatures he has made d loves to bless, in answer to their prayers, and often without them, would be tirely satisfactory to the Christian; and if these were performed in the order of ture, the demands of science would be satisfied.

But the question now arises: How is this apparent subserving to law consistt with special providence and prayer? This is, doubtless, at present, the real ttle-ground between the theistic and materialistic schools of thought. It may answered briefly, that He who has established law as his plan of governing the iverse is not a slave bound in chains of subjection to the creature of his n hand. But the objector urges that changes in nature, brought about in aner to prayer, would be "a violation of the order of nature," a "contradicn of natural laws;" and "no act of humiliation, individual or national can

effect this. Yet, this same objector, Mr. Tyndall, acknowledges, at another plac
and time, that "it is no departure from scientific method to place behind natura
phenomena a universal Father, who in answer to the prayers of his children alter
the current of phenomena." Again, we are told every effect must have a cause
and if the prayer of individuals could modify or change these causes, it woul
destroy the uniform workings of Nature's laws, and then they would cease to *l*
laws. "The course of nature is deaf to prayer and entreaty."

Such objections are based upon a short-sighted view of the question. W
have already admitted that uniformity is the order of nature and cheerfully ad
in the language of another, that "the regular order of nature is the house we li
in. It could not be disturbed by frequent miracles and be fit for the training
rational beings." It is never thus disturbed without a sufficient cause. And,
we seek a reason for such modification, we find it in the fact of man's free agen
and sin. As sin, a supernatural cause, has produced derangement and deform
ty in nature, miracles, also supernatural, are needed to undo its evil cons
quences. As supernatural violations of the laws of health have brought disea
upon the human body, the remedies of a physician, also supernatural, are esse
tial to a restoration of the system to its normal operations under Nature's law

I have often seen an engineer start and stop his engine at irregular interva
cause it to move rapidly or slowly, to continue in motion for a long or for a sho
time, to go backward or forward, at the will of another who was appointed
direct his movements; yet the engineer not once violated the law according
which the engine operated. One can do this who knows but little about t
method of constructing the engine whose workings he modifies at will. And
it not strictly in harmony with the highest reason to suppose that He who forme
in minutest detail, the mechanism of nature, and upholds all things by the wc
of his power, can and does modify the movements of this complicated machine
at the confiding request of those whom he has commanded to pray and who
prayers he has promised to hear and answer? True, every event must have
cause, and this direct cause is the effect of some more remote cause, and so
infinitely beyond the reach of human reason. The final, or first cause, of ev
phenomenon is God working through this long chain of cause and effect. Pra
effects a change at the first link, or staple, through God himself, and thus, a c
responding change through the entire chain; therefore all is in accordance w
the laws of nature.

Man can *by his own acts* interfere with the harmonious workings of natu
He can cause rain by conflagration or cannonading or, more slowly, by the pl
ing of trees. He can and does, by his interference with nature, modify the ri
of the climate and increase or diminish the fertility of the soil. He is consta
overpowering the force of gravitation. He can modify at will the chemical fo
and also those of heat, light, and electricity. He can act in numberless ways
the chain of cause and effect from without, producing new results by new c
binations of nature's laws; yet he does not destroy or render ineffective tl
laws. And not only can he induce disease or health in the animal system

physical appliances, but he can do the same *without* these appliances, and can even destroy life by acts of his will without acting in any physical way upon his victim. And if the will of finite man can act upon nature in harmony with her laws, and the spirit of man can *directly* move for good or ill his fellow man without any known use of these laws, has not the infinite God equal power? There are higher laws than the physical by which mind acts on mind and spirit on spirit, and if *man* can move man thus without the incumbrance of physical laws, cannot God? Rev. E. P. Roe has beautifully said: "The throne of God seems a long way round to reach the friend at our side—for the mother to reach the child in her arms—but it usually proves the quickest and most effectual way."

"Is any sick among you? let him call for the elders of the church; and let them pray over him, annointing him with oil in the name of the Lord; and the prayer of faith shall save the sick, and the Lord shall raise him up." "The effectual, fervent prayer of the righteous man availeth much." "Elias was a man subject to like passions as we are, and he prayed earnestly that it might not rain; and it rained not on the earth by the space of three years and six months. And he prayed again, and the heavens gave rain, and the earth brought forth her fruit." These are declarations of infinite wisdom, from him who holds in his hand the last link in the long chain of nature which makes *tangible* communication between God and man, and of God the spirit who, we doubt not, can reach the spirit of man in a much more direct way.

True, prayers from thousands of Christian hearts went to heaven for the recovery of our murdered President; and yet he died. Does this disprove the efficacy of prayer? Nay, verily. May not Christ's reply to his disciples, when they asked why they could not heal the lunatic who was sore vexed with a devil, explain the matter? "Because of your little faith." If you had sufficient faith you might have removed this mountain of difficulty. "Howbeit this kind goeth not out but by prayer and fasting." Did the destruction of Sodom prove that Abraham's prayers for its preservation were of no avail? Were not his petitions granted just so long as his faith held out and he continued to offer them? Who shall say that if he had persevered till he had reduced the number of righteous necessary to save the city to one (Lot), God would not still have given him the city! Men in prayer are too much like the aged lady behind a runaway horse, who could trust in the Lord till the breeching broke, and then lost all expectation of help. So long as the good President and his noble wife, with the surgeons, held on to the bare "*chance*" of recovery, the people saw encouragement to pray; but when the last chance had vanished from the eyes of men, and the only hope was in God, might not then the faith that would have honored God alone, and that cometh by prayer and fasting, have prevailed and raised, as from the dead, him whom all the world now mourns?

RESPONSIBILITY OF THE INSANE.

In the January number of the *North American Review*, a quintet of phy cians, who have the reputation of being especially intelligent upon the subject insanity, discuss the question of its moral responsibility. The sum of their d quisitions impresses upon the reader the fact that the proper treatment of t matter by the courts is yet in an uncomfortably dense fog, and that the best th can be done, in the absence of definiteness, is to judge each case on its indivi ual merits. All admit that society must protect itself, but there the unanimi seems to end, though the idea is substantially advanced that too many crimin escape upon untenable pleas of insanity. If the doctors can do no more for than this, the difficulty of procuring intelligent statutes from legislators must appreciated.

Dr. J. L. Elwell leads off in the discussion with a paper which is severe the tendency to expand the insanity line of defense. He says that "there is dispute as to the entire irresponsibility of those not knowing the difference betwe right and wrong," but there he would draw the line. This class, he claims, i very limited one, and is rarely guilty of capital crimes. "On the other har the number of alleged insane thrown to the surface, as the emergency requi —for whom the defense of irresponsibility is so constantly interposed in courts justice—probably constitute ninety-nine per cent of all the insane populatio Evidently very few alleged insane murderers would escape if Dr. Elwell had way. He claims that society has the same right to protect itself that an indiv ual has. The object of courts is the protection of society. "They are not n sionary bodies for the conversion of the vicious classes," and society needs m protection from the insane than from the sane. "It is said this is inhum but would it not be more inhuman and brutal to spare the criminal at the pense of society? To whom belongs the greater right to live, the assassin or ciety, any member of which is constantly exposed to death at his hands There have been so many refinements and amplifications of insanity of late, t specialists can prove almost any one insane. Dr. Elwell shows that if Garfi had killed Guiteau instead of Guiteau Garfield, the former could have presen a good defense, from the fact that it could be proved that he had been repeate superstitious about his death, and yet no more sane man lived than he. writer does not dwell on the medical aspects of lunacy; he confines himself m ly to the defense of society, and closes thus: "This being the alarming stat the question we have tried to examine, is it not time that the mania for excus crime on the ground of moral insanity be arrested, either by the medical pro sion, the courts, by the common consent of the people, or by all?"

Dr. George M. Beard approaches the subject in an entirely different s from that of Dr. Elwell. He calls a halt and criticises the angry mood that people are now in, contending that if Guiteau had killed a bootblack instead president there would be no difficulty at all about his acquittal. He says:

there be such a disease as insanity, then Guiteau is and was insane, and has been for years, and the assassination of the President was not needed to make the diagnosis sure." He recites a number of cases which have come under his personal treatment to show parallel instances of undoubted insanity. The fact of Guiteau's moral irresponsibility being established in Dr. Beard's mind, he denies that society will be benefited by his hanging. He writes: "Thirty days we mourned for Garfield; we should mourn for years were we to hang his assassin, after having proof of his irresponsibility. We are more likely, as a nation, to give up our homes and live in wigwams than to judicially and uniformly shoot or hang the irresponsibly insane." He claims that the punishment of such persons by hanging would not deter other insane individuals from crime, but would invite and urge them to commit it. He supports his theory at length by illustrations of the effect of terrible examples on weak and deranged minds. "The sight or tidings of horrid crime or of horrid punishment, so acts on natures organized for insanity and tilted on its edge as to throw them completely over, and cause them to repeat the crime at the risk of punishment. Milder and less imposing procedures, that act less violently on the emotions—such as flogging or confinement in jail or asylum—have the deterring, without the attractive, force of punishment." We have not the time or space here to give to Dr. Beard's argument the attention it deserves, but its drift can be seen at once, and anything coming from his scientific and studious mind commands respect. He has nothing to urge against Guiteau's confinement for life.

Dr. Seguin enters at length upon the discussion of the different kinds of insanity. He is opposed to capital punishment on general principles, but otherwise is scarcely less severe in his strictures upon the release of criminals on the plea of insanity than Dr. Elwell. He believes "that the criminal insane should be held just as responsible to human punishment—*i. e.:* preventative and educating punishment—as sane criminals. Society must protect itself against crime more intelligently, yet more rigidly, than it now does." Dr. Jewell says that, while a knowledge of right and wrong may be accepted as the general standard by which to judge of the responsibility of the insane, there are occasions where irresistible impulse acts against that knowledge. He would therefore give the alleged insane person a little better opportunity for escape than the other authorities. He dwells upon the difficulty of determining doubtful cases, and suggests comparing the act committed with the probable conduct of sane persons under like temptations or motives. He also recommends the adoption of methods to raise the jurisprudence of insanity from its low conditions. He thinks this might be accomplished by associating competent medical men with the judge and jury in such cases.

Dr. Folsom discourses mainly upon the growth of mental disease and incontrollable impulses. The best he can do to help us out of the difficulty is to claim that there must be other evidences of insanity than the crime, that the whole group of symptoms must correspond to a definite disease; that crime must be a part of the natural history of the disease, and that a reasonable degree of self-con-

trol should be exercised according to the capacity for it in each case. Beyond that point, he says, is endless confusion if we hold men irresponsible. Men are responsible if they possess "mental capacity for ordinary reason, reflection and judgment, the knowledge of right and wrong as applied to the particular act, the power of self control within reasonable limits, the absence of insane delusions overpowering reason." With the exception of Dr. Beard's views, the general drift of the discussion tends toward holding Guiteau responsible.—*Globe-Dem.*

STATE ASSASSINS AND THE DEFENSE OF INSANITY.

BY JAMES W. CLARKE.

The tragedy of the 2nd of July, last, suddenly revived public interest in an old topic,—the defense of insanity in capital cases. It is a well-worn theme, much discussed, and always with an unsatisfactory result. What is moral insanity? What is legal insanity? Conclusive answers to both these questions have often been attempted, but never given with such definiteness and decisiveness as to shut off debate. Every day the controversy is resumed in our courts, and apparently will go on to the end of time. It is settled one day, and the day after we find it is not settled at all. "What," said the late Dr. Forbes Winslow, "is my test of insanity? I have none. I know of no unerring, infallible, and safe rule or standard applicable to all cases." So, too, the British judges, whose effort to define the undefinable we shall presently examine at length, after all their elaboration of statement touching what does and what does not constitute legal insanity, finally confessed that "the facts of each particular case must of necessity present themselves with endless diversity, and with every shade of difference in each case." But if it be difficult to define what is legal insanity, which is a mere matter of human law, how much more difficult is it to determine and define what is moral insanity? Dr. Sam Johnson declares that "all power of fancy over reason is a degree of insanity," and Montaigne asserts that between genius and madness there is but "a half turn of the toe." M. Taine concurs in this dictum, and philosophically avers that "insanity is not a distinct and separate empire; our ordinary life borders upon it, and we cross the frontier in some part of our nature."

It has been the periodic mission of the assassin to revive this moot question. One day the world stands and shudders with an unanimous horror, and the next divides upon the old issue,—Was he insane? It is oppressively monotonous, in looking back over these historical tragedies, to find how invariably the modern imitator of Brutus comes down to the foot-lights with a pistol in one hand and plea of insanity in the other. In American history, so far, we have had only two creatures corresponding to what, in the vocabulary of Europe, would be called regicides. In the first case there was no opportunity offered to the assassin to plead insanity. A vast amount of legal lore and medical metaphysics was for

stalled by the summary shooting of Wilkes Booth in the barn where he was brought to bay.

It is, perhaps, worthy of note that not one of the men who have of late murdered or attempted to murder, czars or emperors, has offered the plea of insanity. In Great Britain and the United States it seems to be the assassin's invariable defense. And in both countries counsel for the accused start with the advantage of being able to ask the jury, as Mr. Cockburn did in the cases both of Pate and McNaughten,—Could they believe that any sane man could have committed such an act? And that is the question which the tragic event that has recently shocked and saddened both hemispheres once more invests with melancholy importance and presents for decision to an American jury.—*December Atlantic.*

GEOGRAPHY.

THE JEANNETTE—PROBABILITIES.

BY P. A. TOWNE.

It is very likely that the reader has occasionally stumbled upon the remark that "history is constantly repeating itself." Whether true or not, it is often a very convenient mode of introducing what one wishes to say. No one can have followed the reports of the several expeditions sent out in search of the Jeannette during the past summer without having been painfully reminded of similar reports from expeditions in search of Sir John Franklin after his last and fatal voyage in Arctic exploration. It is to be hoped that the parallel between the two histories will stop with the events of 1881. Let us see if the probabilities are not in favor of the belief that such a wish will be realized.

Lieut. DeLong was last seen in September, 1879, steering toward Wrangel Land. During the past summer Wrangel Land has been visited twice, and Lieut. Berry has not only circumnavigated it but has skirted the impenetrable ice some sixty miles, or one degree, north of it. He saw no land between it and the North Pole. Wrangel Land is at about 72° north latitude, and its distance from the Pole is therefore about 1,260 miles. In July, 1827, Capt. Parry went in an iceboat to a point on the ice 82½° north latitude. This point is north of Spitzbergen. The three points, Wrangel Land, the Pole, and Spitzbergen are in almost a straight line, with the Pole between the two extremes. The land lying nearest the North Pole, which has been seen, is called Petermann Land, and is in latitude about 84° north of Greenland. If Petermann Land is not a myth it is only about 420 miles from the Pole. Cape Joseph Henry is in its neighborhood, and is in about latitude 83° north. The point of the Eastern Continent

nearest the Pole is Cape Tcheliouskin, which is in latitude 77½° north, or about 840 miles from the Pole. Franz Joseph Land to the east of Spitzbergen is in latitude 82° north, and Nova Zembla is in latitude 97° north. Herald Island, to the east of Wrangel Land, is in latitude 72½° north.

From these data it is seen that the centre of the unexplored region of the Arctic Ocean is not the North Pole, but a point about 84° north latitude, between the Pole and Wrangel Land.

The reports of the past summer teach us, if they teach anything at all, that in September, 1879, Lieut. DeLong may have found an opening in the ice north of Wrangel Land. He was last seen steaming onward in an apparently open sea. He was engaged in by far the most fascinating exploring expedition now possible to navigators. His instructions were to go to the North Pole, if possible.

If he found his way clear he did not spend even twenty four hours in considering the question of stopping at Herald Island or Wrangel Land. He went through the opening without hesitation, trusting the rest to his good luck. He was near Wrangel Land in the most favorable month of the year. If the sea was open he could reach the goal of his ambition in as few as eight or ten days from the time he was last seen. But once on the north side of the ice barrier he was there not only for a few months, but, it may be, for years. He found the sun in the southern horizon, and a few days later the long night of five or six months shut him out of the possibility of retreat by way of his entrance into the polar basin. Ice formed quickly around his little ship. If he found an island he landed upon it, fixed up his winter quarters, and waited for the appearance of the sun in 1881.

In 1827 Capt. Parry found himself on ice moving south faster than he could draw his boats upon it toward the north, and not only so, but the ice was thinning so rapidly as to compel his retreat toward Spitzbergen. This fact seems to indicate that the current of the Arctic Ocean, at least in some years, moves across the Pole from the direction of Wrangel Land toward Spitzbergen, and that it is, therefore, entirely within the limits of probability that DeLong may emerge from the Arctic basin by way of Spitzbergen in 1882. He was provisioned for three years, and he had, therefore, no reason not to take the greatest possible advantage of his presence in this new and wonderful field of discovery. There was no need of hurrying back to a more comfortable climate, even though his exit from the Polar seas has been possible during the past summer.

But whether the unexplored part of the Arctic Ocean be entirely free of land, or whether it be an archipelago, there is no point in its circumference at which DeLong may not make his appearance in 1882. His most likely point of exit is Spitzbergen, but his final success in efforts to reach civilization once more must depend upon his skill as a navigator in the midst of vast floating fields of ice. He must go wherever the ice carries him. The only alternative which an examination of the most recent maps of the Arctic regions suggests is, that DeLong and his ship went to the bottom in the autumn of 1879. We are not ready to believe this to be the case, nor are we ready to conclude from the present condi-

tion of the history of his expedition that "the North Pole is inaccessible." It is evidently the purpose of Lieut. Berry to follow DeLong in 1882 if he can, and we hope he will find no obstacle to so doing. We do not believe there is any use in hunting along the coast of North America. He did not go in that direction. He went toward the North Pole, and in that direction he must be looked for. He must be followed if he is found. If no one has the courage to do that, then let us wait till the Jeannette appears.—*The Sentry.*

EXPLORATIONS BY USE OF BALLOONS.

Commander Cheyne of the English Navy, is in New York, endeavoring to raise $80,000 to equip an Anglo-American Expedition to find the North Pole. This English naval officer has participated in three polar expeditions, and is an experienced navigator in northern latitudes. He proposes a novel plan to reach his objective point: His intention is to go to the highest latitude attainable by vessel, then take to dog-sleds, and when the mythical "open sea" is reached, he proposes to employ balloons to make the rest of the journey. Lieutenant Schwatka, of our army, who is a recent Arctic celebrity, approves of Commander Cheyne's method, and will accompany him on his expedition if he be successful in obtaining the funds to fit it out.

Mr. Grinnell, son of the merchant-prince, of New York, who contributed so liberally to the search for Sir John Franklin, is said to be ready to aid Commander Cheyne to any reasonable extent necessary, and the exploring vessel is to be named "The Grinnell."

ASTRONOMY.

ASTRONOMICAL NOTES FOR JANUARY, 1882.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.	Declination S.	Equation of Time.
1st.	18h. 49m.	22° 58′	3m. 59s.
15th.	19 50	21 04	9 48
31st.	20 57	17 15	13 45

THE MOON.

Date.	Right Ascension.	Declination N.	Semi-diameter
1st.	4h. 50m.	22° 01′	12′ 15″
5th.	8 15	15 29	14 49
10th.	12 00	5 11 S.	14 54
15th.	16 15	21 29	15 57
20th.	21 21	10 22	16 42
25th.	1 55	14 56 N.	15 48
31st.	7 13	19 13	14 52

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage
1st.	18h. 37m.	24° 46′	11h. 52m. A. M.
15th.	20 16	21 55	0 36 P. M.
31st.	21 57	13 26	1 17

Semi-diameter on the 1st, 2.3″; on the 31st, 3.0″.

VENUS.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Transi
1st.	17h. 56m.	23° 22′	11h. 11m. A. M.
10th.	18 51	23 16	11 26
20th.	19 45	21 57	11 41
31st.	20 43	19 15	11 56

Semi-diameter on the 1st, 5.2″; on the 31st, 5.0″.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Trans
1st.	6h. 16m.	27° 03′	11h. 34m. P. M.
10th.	6 01	27 10	10 39
20th.	5 51	27 06	9 49
31st.	5 46	26 55	9 01 P. M.

Semi-diameter on the 1st, 8.2″; on the 31st, 6.6″.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Trans
1st.	2h. 57m.	15° 44′	8h. 14m. P. M.
10th.	2 57	15 45	7 34
20th.	2 57	15 50	6 55
31st.	2 59	16 04	6 14

Semi-diameter on the 1st, 21.5″; on the 31st, 19.5″. On the 10th at 3h M. it will be stationary in right ascension.

JUPITER'S SATELLITES.

Abbreviations used: In. denotes ingress; Eg., egress; Dis., disappearan Re., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of satellite; S transit of shadow. K. C. M. S. T. to be used in observations.

DATE.		PHENOMENA.		DATE.		PHENOMENA.	
3rd,	10:13 p. m.	Ganymede,	Oc. Dis.	14th,	10:51 p. m.	Ganymede,	Sh. Eg.
4th,	10:28 p. m.	Io,	Oc. Dis.	20th,	8:40 p. m.	Io,	Oc. Dis.
5th,	7:40 p. m.	Io,	Tr. In.	21st,	6:10 p. m.	Europa,	Oc. Dis.
	8:50 p. m.	Io,	Sh. In.		7:10 p. m.	Io,	Sh. In.
	8:55 p. m.	Europa,	Sh. In.		7:43 p. m.	Ganymede,	Tr. In.
	9:19 p. m.	Europa,	Tr. Eg.		8:05 p. m.	Io,	Tr. Eg.
	9:53 p. m.	Io,	Tr. Eg.		9:22 p. m.	Io,	Sh. Eg.
	11:02 p. m.	Io,	Sh. Eg.	22nd,	6:36 p. m.	Europa,	Ec. Re.
6th,	8:15 p. m.	Io,	Ec. Re.	23rd,	6:10 p. m.	Europa,	Sh. Eg.
7th,	6:06 p. m.	Europa,	Ec. Re.	28th,	7:44 p. m.	Io,	Tr. In.
	6:50 p. m.	Ganymede,	Sh. Eg.		9:05 p. m.	Io,	Sh. In.
12th,	9:09 p. m.	Europa,	Tr. In.		9:57 p. m.	Io,	Tr. Eg.
	9:32 p. m.	Io,	Tr. In.		11:17 p. m.	Io,	Sh. Eg.
13th,	6:47 p. m.	Io,	Oc. Dis.		11:36 p. m.	Ganymede,	Tr. In.
	10:11 p. m.	Io,	Ec. Re.	29th,	8:32 p. m.	Io,	Ec. Re.
14th,	6:13 p. m.	Io,	Tr. Eg.	30th,	6:11 p. m.	Europa,	Sh. In.
	7:26 p. m.	Io,	Sh. Eg.		6:12 p. m.	Europa,	Tr. Eg.
	8:42 p. m.	Europa,	Ec. Re.		8:49 p. m.	Europa,	Sh. Eg.
	8:59 p. m.	Ganymede,	Sh. In.				

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 16m.	11° 3′	7h. 34m. P. M.
10th.	2 16	11 5	6 54
20th.	2 17	11 11	6 16
31st.	2 18	11 22	5 34

SATELLITES.

Kansas City Mean Time of the first elongation visible, East and West.

	DATE.	DATE.
Mimas.	4th, 9:20 P. M., East.	On the 12th, 9:38 P. M., West.
Encelahns.	1st, 1:14 A. M., East.	Not visible.
Tethys.	14th, 7:14 P. M., East.	Not visible.
Dione.	7th, 8:16 P. M., East.	Not visible.
Rhea.	6th, 1:16 A. M., East.	Not visible.
Titan.	Not visible.	On the 8th, 5:44 A. M., West.
Hyperion.	2nd, 9:32 P. M., East.	On the 8th, 5:20 A. M., West.
Japetus.	11:00 P. M., East.	

The time of other elongations may be found by adding or subtracting the ollowing periods:

Mimas.	0d.	22.6h.	Rhea.	4d.	12.5h.
Enceladus.	1	8.9	Titan.	15	23.3
Tethys.	1	21.3	Hyperion.	21	7.8
Dione.	2	17.7	Japetus.	79	22.0

APPARENT ELEMENTS OF THE RING.

Outer Major Axis 41.4″, Minor Axis 12.9″.

Inclination of northern Semi-Minor Axis to circle of declination from North to East, 16.8′.

Elevation of the earth above the plane of the Ring, 18° 13.1′; of the Sun, 20° 10.9′.

Earth's longitude from Saturn counted on plane of ring from the Ring's ascending node on Equator, 87° 45.7′; Ecliptic 45° 01.6′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	11h. 19m.	5° 16′	4h. 35m. A. M.
31st.	11 17	5 32	2 31

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	2h. 48m.	14° 18′	8h. 05m. P. M.
31st.	2 47	14 17	6 03

GALILEO AND CURRENT MYTHS.

At the St. Louis University, November 15th, Rev. H. Calmer, S. J., took up another controverted point of history and discussed it before the post-graduates. The lecture was on Galileo, and another on the same subject will be delivered by the Reverend Father. He began with Von Gebler's statement:

As we study Galileo's connection with the Inquisition critically, we must do way with "the current myths." Then he continued: We might have supposed that after M. de l'Epinois, in 1867, published from the celebrated Vatican MSS. the entire process of his trial and nominal imprisonment, these myths would have ceased circulating. The blinding of Galileo is a creation of the lively popular mind. The fable may have taken rise from the subsequent loss of his sight. The assumed exclamation "*E pur si muove*" is legendary. No modern historian of note gives it any credit. Nor did he recant, clad in the "hair shirt." The official document, although it goes very much into detail as to the way in which the oath was performed, says nothing of the shirt, and neither should authors have said anything about it.

Moreover, one glance at the truest historical resource for the famous trial—the official dispatches of Niccolini to Cioli—would convince any one that Galileo spent altogether only twenty-two days, not in a prison cell with grated windows, but in the handsome and commodious apartment of an official of the Inquisition. Was he tortured by the Inquisition? "Those who undertake to accuse the Inquisition on this point are forced to have recourse to fiction," says Von Reumont, and with him agree Lord Brougham, Biot, Von Gebler, and other authors worthy of trust. The expression, "examen rigorosum," found in the decree, proves a

most a "territio verbalis." Consult on this the Letters of Galileo, Limborch's "Historia Inquisitionis," and the Vatican MSS. Nor were the latter tampered with or withdrawn. "Galileo was not a martyr of science," says Henry Martin. Finally, nor was Galileo "forced to ask pardon of God by a retrograde clergy, for having revealed the eternal and ravishing harmonies by which he rules the universe." To the pontiffs and dignitaries of Rome we are mainly indebted for the Copernican system. Galileo was not the first to broach it. Cardinal Nicholas de Cusa promulgated it before Copernicus. The system was taught in the Jesuit University in Rome. Another Jesuit explained it at Sapienza, the Pope's own University. As long as it was treated as a scientific and not a religious question, the church put no hindrance in the way. Galileo was no exception. Gardens and palaces were flung open for his use, and prelates and cardinals were his admiring attendants. Whence, then, the change in 1616?—*Globe Democrat.*

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

RAIN-FALL, AT WASHBURN COLLEGE, BY MONTHS, FOR THE LAST THREE YEARS.

MONTHS.	1879	1880	1881
January	1.20	No record.	0.60
February	0.34	0.68	2.600
March	0.15	1.76	1.34
April	3.872	1.404	1.085
May	3.55	3.588	3.81
June	5.901	5.835	5.84
July	3.923	3.09	0.85
August	0.519	9.11	0.72
September	1.852	2.42	2.74
October	2.457	3.08	4.65
November	7.218	1.76	1.70
December	2.154	0.35	0.40
Total	33.136	32.777	26.335

Highest barometer during month 29.48, on the 23rd. Lowest barometer during month 28.71, on the 29th.

Highest temperature during month 63, on the 29th. Lowest temperature during month 6, on the 24th.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Nov. 20th to Dec. 1st.	Dec. 1st to 10th.	Dec. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	23.0	26.2	29.2	26.1
Max	47.3	45.5	49.8	47.5
Min. and Max	35.1	35.8	39.0	36.6
Range	24.3	19.3	19.6	21.1
TRI-DAILY OBSERVATIONS.				
7 a. m.	30.4	31.2	35.7	32.4
2 p. m.	41.7	44.6	47.7	44.7
9 p. m.	33.4	37.1	40.7	37.1
Mean	34.8	37.6	42.3	34.9
RELATIVE HUMIDITY.				
7. a. m.	.80	.79	.80	.80
2 p. m.	.62	.62	.70	.65
9 p. m.	.69	.72	.85	.75
Mean	.70	.73	.78	.74
PRESSURE AS OBSERVED.				
7 a. m.	29.07	29.12	29.08	29.09
2 p. m.	29.14	29.06	28.02	29.07
9 p. m.	29.09	29.09	29.04	29.07
Mean	29.08	29.09	28.05	29.07
MILES PER HOUR OF WIND.				
7 a. m.	12.6	10.3	10.8	11.2
2 p. m.	18.3	16.2	15.5	16.7
9 p. m.	11.9	14.0	14.0	13.3
Total miles	3806	3311	3630	10747
CLOUDING BY TENTHS.				
7 a. m.	4.6	5.3	6.7	5.5
2 p. m.	3.1	7.8	7.7	6.2
9 p. m.	3.0	6.6	6.4	5.3
RAIN.				
Inches	——	——	.40	.40

PRECIPITATION AND THE STORM-CENTRE.

BY S. A. MAXWELL, MORRISON, ILL.

In a former article to the REVIEW, I attempted to show the relative positions of the storm-centre and the locality of tornadoes. In the ten instances of tornadoes there cited, all occurring in 1878, every one was found to be developed on the equatorial, or right-hand side of the path of minimum pressure. My investigations at that time led me to believe that other storms, besides tornadoes, had similar relations to the storm-centre.

Inasmuch as winds almost invariably blow toward the storm-centre, and the warm winds are the generators of rain, I came to the conclusion that the localities of greatest rain-fall would be found to the south of the track of "low." I constructed the following table to prove the truth of this conclusion. The table, made out from the Signal Service Weather Map for August, 1878, shows the

localities in the United States where rain-falls of more than three inches occurred, with the several dates, also the direction and approximate distance of "low" from the locality of the storm ;

STATION.	RAIN-FALL, INCHES.	DATE.	DIR. OF ST'M-CENTRE DURING STORM.	DISTANCE OF SAME.
Flushing, N. Y.	3.65	1st.	N. NW.	500
Ft. Barrancas, Fla	3.75	3rd.	N. NW.	1000
Colebrook, Conn	6.67	4th.	W.	600
Newark, N. J	3 04	6th.	N.	400
Boston, Mass.	4.04	8th.	NW.	700
Charleston, S. C	7 71	13th.	S.	800
Mt. Sterling, Ill	4.00	17th.	W. NW.	400
Mt. Desert, Me.	3.15	17th.	NW.	400
Wood's Holl, Mass	5.11	18th.	NE.	400
Elmira, Ill.	3.29	19th.	W. NW.	150
Springfield, Mo.	3.30	21st.	NW.	400
Green Springs, Ala	3.10	29th.	W.	200
Ft. Barrancas, Fla	9.75	30th.	SW.	400
Spring Garden, Tenn	4.70	30th.	N.	1000

The table gives fourteen storms, while the Signal Officer's report for the month names seven additional ones; but these not belonging to "charted storms" could not be included in the table. Of these fourteen, eight occurred on the right-hand side of the line of low pressure, and three of the remaining six, on account of the extraordinary direction taken by "low," took place on the left side of it. These three were the storms at Mt. Sterling and Elmira, Ill., and at Springfield, Mo., accompanying the storm-centre which passed over central Iowa on the 18th and on the 19th changed its course to the south, then to the west, and was last reported from southern Nebraska on the 20th. These three storms, though occurring to the left of the line of low pressure, were in localities where southerly winds prevailed, and hence were the results of precisely the same causes that produced the eight storms belonging to the other half of the storm-area. Of the remaining three storms, one occurred at Green Springs, Ala., on the 29th, and another the next day at Ft. Barrancas, Fla. They both belonged to a storm-area which also took an unusual course, viz: from north to south. Since "low" passed through the State of Mississippi the localities named were on the left side of the track; but in these instances the excessive precipitation was due to the mingling of the saturated surface winds from the Gulf with the cooler air of a higher stratum, as it ascended in the vicinity of the storm-centre.

The storm at Charleston on the 13th, may not have belonged to the storm-area whose centre was 800 miles to the south, but to another whose centre was 1,000 miles to the northwest. I think it more probable that it belonged to the latter, from the fact that the effects of the passage of "low" are felt much farther on land than on the sea. This latter fact is easily accounted for; since the sea absorbs the solar heat, while the land surface parts with it readily by radiation, thus

forming ascending currents of greater power than those produced over the surface of the ocean.

Thus it will be seen that while no doubt exists as to the eight storms occurring on the right of the line of low pressure, those on the left were the result mainly of accidental, and even extraordinary, conditions. Upon examining the weather-maps of other months I find still more convincing proofs that the great majority of heavy rain-falls occur in the right half of the storm-area; and of these the larger number are somewhat in advance of the storm-centre.

When the people learn to study the weather by means of the weather map and by their own observations, and place no reliance on the foolish generalizations of false prophets, they will then get possession of practical scientific facts of great value. If these facts were properly understood by the farmers of our country, it might result in the saving to them of millions of dollars annually.

November 19th, 1881.

THE METEOROLOGICAL CONDITIONS OF CHRISTMAS WEEK FOR THE PAST NINE YEARS.

BY P. F. LYONS, SIGNAL CORPS, U. S. A.

[*Taken from the United States Signal Service Records, at Leavenworth, Kansas.*]

The old adage "Green Christmas, open Winter," etc., etc., has been so closely allied to if not really a household expression, that we are prompted to give a review of the state of the weather as observed in this immediate vicinity during the winters of the past nine years. The principal point aimed at, however, although not strictly scientific, is to show the degree of credulity that may be attached to the adage "Green or warm Christmas without snow presages an open winter," and the converse, *vice versa.*

The Records are as follows: December 23rd, 1871, shows a snow-fall of six inches on that day, which was preceded and succeeded by a reasonably cold spell and hence a "White Christmas" followed by a fair average winter. December 19th, 1872, a snow-fall of six inches was had; it was the forerunner of a severe cold spell, which lasted for some time. A decidedly "White Christmas" was that, and the immediate winter fully up to the average, exceeding the former one in severity.

The third annual cycle is shown by our records to be a repetition of December 23rd, 1871, as to snow; but the amount was very small and it rapidly disappeared before the close of the following day: that Christmas was "green" and the old adage, "moderate winter" resulted. December 21st, 1874, a snow-fall of eight inches, followed by a moderately cold spell—snow mostly disappeared by Christmas; some severe cold snaps were had that winter, and the advocates of

of the old saying had to call it a "draw" that season, for the day was really a rather complex one, or a mean between the "white and green."

The character of the next Christmas was undoubtedly "green" and the succeeding winter decidedly open. The same day one year later, 1876, was literally "white," as snow fell both on the eve and day of the gladsome festival. A temperature prevailed during December and January of that season that was decidedly winterish and at times frigorific. The next annual cycle brought a return of a "Green Christmas," and there ensued a remarkably open winter, the lowest temperature observed that solstice was 6° being on January 6th.

In 1878 the winter began early in December, of that year, and continued to increase in severity, and on the 2d of January, following, the minimum fell to 12° below zero, and for the subsequent five days ranged at from 7° to—12.5°. With the exception of the 15th, the temperature remained continually below the freezing point from the 13th of December, at which time a snow-fall of eighteen inches occurred, until the 20th of the following month. We need hardly add that the Christmas of 1878 was decidedly a "white one" and the accruing winter long and severe. The recurrence of the next Christian festival showed a light-tint of snow, which fell on the 23rd, and was followed by a sharp, but short, cold spell that lasted until the 25th: that was all the winter-weather had for that season, and the Christmas, though not absolutely "white," was, certainly, not one conducive to verdure, for the minimum recorded—8°, on the eve of the day. The weather attending the Christmas of 1880, is too fresh in the minds of our readers to need details, further than to simply remark that while the preceding day was not as cold as those of the former one, it wasn't green, "not at all," for the temperature stood almost without exception at, and at times, considerably below 32°, from early in December until the near approach of the vernal equinox.

It would be almost superfluous to say that the Christmas just passed has been the "greenest" known to the oldest inhabitants, for such it really has been. By a comparison of the foregoing it will be seen that there has been a remarkable coincidence in the succession of open weather after a "Green Christmas:" whether the present winter will be anomalous or not remains for the future to determine. With the present meagre meteorological data, we could not venture to say what the outcome will be, for such would be mere conjecture or guess-work, and consequently not within the domain of science.

ON THE TIMBER LINE OF HIGH MOUNTAINS.

BY THOS. MEEHAN.

Mr. Meehan remarked that on the tops of most high mountains we find a total absence of ligneous plants. The highest alpine vegetation consists for the most part of acaulescent perennials. Lower down we may find some woody species, and often we come to dwarfed forms of trees of species, which, stil l

lower down, form forests of considerable height, and which, as timber trees, make what is known to mountain travelers as the "Timber Line." Thus in the mountains of Colorado, the forests commence at about 7,000 feet above the sea level, and continue up to about 11,000 feet, where they suddenly cease, and form at that elevation what is there shown as the "Timber Line." On Gray's Peak he found *Pinus aristata*, *Pinus flexilis*, *Abies concolor*, and *Abies Engelmannii*, with some willows, forming the timber line. The Coniferous trees were probably thirty or forty feet high, and it was interesting to note that this tall timber as suddenly ceased, as if a wood had been cut half a way by a woodman's axe. But at once commencing where the tall timber ceased, the same species exist as dwarf, stunted shrubs seldom exceeding three or four feet in height, and often but a foot, though trailing widely over the ground. In this stunted condition the species would often extend some fifteen hundred feet higher up, or half way from the recognized timber line to the top of the mountain. Other observers have noted that the average of 11,000 feet marks the entire timber line of the Rocky Mountain range.

So far as he knew, this peculiar timber line has been referred wholly to climatic conditions, of which temperature and moisture have been regarded as the chief elements in producing the results. That admirable botanist and energetic collector, Dr. C. C. Parry, in a paper on the Rocky Mountain alpine region, published in the "Proceedings of the American Association for the Advancement of Science" for 1869, p. 249, remarks that the most satisfactory explanation is that the so called timber line marks the extreme point of *minimum* temperature below which no exposed phenogamous plant can exist. All that survives above this point does so by submitting to a winter burial of snow, beneath which protecting cover it is enabled to maintain its torpid existence.

The great objection which this purely meteorological view presented to Mr. Meehan's mind was that the dwarfed and gnarled coniferæ extending so many hundred feet up the mountain sides, never produced seed, and we are reduced to the alternative of believing either that the seeds have been carried up the mountain sides in enormous quantities and to enormous distances from the fruitive trees below by winds, or else that there were seed-bearing progenitors of these scrubby pines, beneath the tall protecting branches of which they had their earliest stages of growth. He was satisfied from subsequent observations in the mountains of North Carolina, and in the White Mountains of New Hampshire, that this last view is the correct one,—that large timber trees at no very remote period extended much further up the mountain sides than they do now, and that they have since disappeared for reasons presently to be stated, leaving only the younger trees to struggle on as best they may.

Roan Mountain in North Carolina is about 6,300 feet above the level of the sea. Timber extends to its summit on some parts of it, while in other parts it is destitute of timber for many hundreds of feet down its sides. The species on the summit is *Abies Frazeri*, and *Abies nigra*. Oak and other trees come occasionally to near the top and at about 6,000 feet he measured a black oak—*Quercus tinctoria*,

that was five feet in circumference at three feet from the ground, and was perhaps forty feet high. The places destitute of trees were the steep declivities,—while those on which the trees were growing were of a more level character. Further down the mountain sides the steep inclines would be clothed with forest growth, as well as those of a more gradual ascent. It is of the summit only that the differences in inclination presented different forest aspects. But in the spaces clear of "Balsam" as the *Abies Frazeri* is popularly known, an occasional one of good size would be seen. In the close Balsam woods, both on the summit and lower down the mountain sides, crops of young plants would be found under the mature trees, but, what was very remarkable, there had evidently been no young trees started till the parents were near maturity. A large area with trees thirty or forty feet high would have an undergrowth of young ones a foot or so high, while other areas of younger trees, would have innumerable small seedlings growing among the damp moss beneath them, and it was further interesting to note that in most cases the crops of young plants in each area were about the same age in each case, as if the seeds in the several locations had all started to grow together in some one particular year, and probably at no other time. On the naked places, where few or no trees were now found, the surface would be closely covered by a matted growth of a grass almost peculiar to that region, *Danthonia compressa*, but a close examination of the surface showed occasional tracts of deep vegetable mold which had been formed by ages of decaying *Hypnum* or Sphagnum moss, and the evident remains of roots, just as we now find under the Balsam trees, and there is no doubt from these facts that these steep upper declivities were once clothed with trees and mosses, to which the grass previously named succeeded.

With these facts in mind he examined the arboreal features of the White Mountains in New Hampshire. On Mount Washington which is a little over 6,000 feet, the timber runs up to about 4,000 feet; while Mount Webster, a mountain forming the southern peak of the same chain, and about 4,000 feet high, has little timber above 3,000 feet. Clearly, climatic reasons will not account for these peculiarities. On Mount Washington there is much of the same character as distinguishes the forest of the Rocky Mountains. As already noted the timber line becomes marked at about 4,000 feet. For at least another thousand feet we meet with scrubby bushes of *Abies Balsamea*, *Abies nigra*, and *Abies alba*, with some *Betula papyracea*. Beyond this, and almost to the summit, an occasional specimen of one or another of the coniferæ may be seen. As noted in regard to the Colorado scrubby growth, none of these had ever produced seed; nor was it at all probable, from a careful survey of the locations, that many of the areas could have been seeded by the winds, however strong, bringing the seeds up these mountain heights. Moreover, there were many cases where there were intermediate areas clear of all scrubby spruce plants, and where seeds could be brought by winds in these modern times much easier than to the heights above. Besides this, it was evident that many of these dwarfed specimens were of immense age. Some that he examined were certainly fifty years old, though the

stems at the ground were no thicker than his wrist, and trailing on the ground, occupied but sixteen or twenty square feet of space. There seemed to be but little doubt that at some time in the past Mount Washington had forests of coniferæ at much higher elevations than at present, if not perhaps clean up to the summit; that these scrubby plants now there were seedlings that had sprung up under the elder ones, and that in time the older ones were destroyed, leaving the small ones beneath alone to their fate.

An examination of different parts of Mount Washington shows not only that this is the true explanation of the absence of good timber beyond what is known as the timber line, but that the same law is in progress to-day as in centuries past. Illustrations of this are numerous. There is now a railroad running straight up the mountain side from the base to the summit. Near the timber line, a cut had to be made through an area covered by mature Balsam Firs. This cut was about eight or ten feet deep. Under the trees, moss and dead roots and old fir leaves had made an earthy strata of a foot, or in places, more in depth. The moss was still green from the rains, melting snows, and fogs of this elevated region, and sustaining the various kinds of low vegetation common to these alpine heights. Young firs were springing up in great abundance. But all the larger trees were dead, though here and there might be seen a branch with a few lingering green leaves. This mass of dead, standing timber occupied several acres. The reason for their death was evident. The railroad cut showed that the forest stood on a mass of large but loose gneiss rocks, through which the waters from the two thousand feet of loose rock above rushed as soon as the railroad cut was made, carrying with it all the earthy matter on which the larger trees subsisted, but leaving the tough turfy matter at the surface, on which smaller trees of the same sort may live for many years, though the larger ones cannot longer exist. With the death of the larger trees there is, of course, an increase of light, and then the *Hierochlæ*, with other grasses and sedges, speedily take possession, holding together the loose soil, and even permitting in many cases an increase of the earthy layer, by holding much of the disintegrated rock which may be washed or blown on from above. Carefully examining patches of scrubby spruces above the timber line, it is not uncommon to find dark patches of vegetable mould evidently the remains of large trees that have been growing where now only the masses of small scrubby plants exist. In some places a sharp stick may be pushed down among the scrubby firs and spruces, and the earth found to be but a foot or so deep over the loose rock below, from which the earth has been wholly washed away. Again, there are some places, often nearly an acre in extent, where the scrubby firs are still standing, dead, from the earth having been washed away from below upward, not leaving enough for even the moderate demands of these little bushes.

In view of the facts detailed we may conclude that at the elevation of these mountain chains, the lowland vegetation was carried up at the same time. The summits, covered by luxuriant forests would present a cooler surface to the moist clouds, and there would be less condensation than on bare sun-warmed rocks,

and deep snows would be less frequent; and not sufficient to interfere much with arboreal growth. But the rain would of necessity carry down the earth and disintegrated rock to lower levels; and the melting snows, such as there were, would make this downward progress of the soil continuous. In some mountains where the rock was easily broken by frost, as in Colorado and the White Mountains, it would be very difficult for the soil to hold its own against these forces of gravitation; but on more solid rock the mass of tree roots protecting the rock, and retaining the earth matter, would longer hold its own. In the former case with the gradual washing away of the earth the larger trees will have to find a lower level; the summit condensing more moisture, and having a cooler atmosphere, would form heavier masses of longer enduring snow, and thus keep down from tall growth the younger trees left as the older and larger ones retired. They would have to be low bushes by the absence of earth for vigorous growth, and remain trailing bushes, through the superincumbent and long continued mass of snow.

We thus see that though a long continued mass of snow has much to do in marking a timber line, that line is precedent to the snowy mass. The primary cause is the gravitation of disintegrated rock—the movement of the hill-top toward the sea. From the moment the mountain reaches its highest point it commences its downward march. The entire reduction of the highest to a level with the plain is but a question of time. The frost and rain and melting snow will do it all, and this reduction, bringing down not only the earth, but cold-loving plants to warmer levels, must continually change the aspects of vegetation, as well as perpetually vary the timber line.

In low hills as well as in high mountains the forces of gravitation are also at work. But the sides are seldom so steep as in the loftier hills,—the rains do not gather with such force nor are the melting snows of near the same duration. There are sudden washes, but not the continuous roll of the earth to the bottom. In time they may exhibit the same phenomena of the disappearance of species from their summits as their loftier brethren; but the centuries here will gather much more slowly to produce a similar effect.

In conclusion he would say briefly that the "timber line" of high mountain tops results from the washing down of the earth from the higher elevations.—*Proceedings of the Academy of Natural Sciences of Philadelphia.*

BOOK NOTICES.

NORSK, LAPP AND FINN. By Frank Vincent, 8vo pp. 263. G. P. Putnam's Sons, New York, 1881. For sale by M. H. Dickinson, $1.50.

Books of northern travel have been unusually numerous during the past year, and Putnams have had the good fortune to put forth some of the best of them.

The volume in hand is the work of an experienced traveler who has visited all parts of the world and some of whose books have been received with great favor. It is attractively written and the amount of information given as the direct observations of the author is large and well handled. No portion of it is heavy or dull; on the contrary the reader will almost certainly take a kind of personal interest in the adventures and investigations of the cheery writer, sympathizing with him in his hardships and enjoying keenly his successes in overcoming them. The work is illustrated with a frontispiece and a route-map, while the table of contents and index are exceptionally full and complete.

Commencing at Paris, the reader is taken, via Hamburg, Kiel and Korsor, to Copenhagen, or "Merchant's Haven," as the Danish word Kjobenhavn signifies when literally translated. To this city of commerce, religion, science, education and art are devoted ten pages, in which the reader is introduced to the the Library and Zoölogical Museum, the Literary and Educational Societies, the University, Thorwalsden's Museum, the Churches, etc.

A whole chapter is devoted to an enthusiastic description of the Museum of Northern Antiquities, the Ethnological Museum, the Chronological Collections of the Kings of Denmark, Relics of early Civilization, etc.

Progressing northwardly we are taken to Christiana, the picturesque fortress of Kronberg, the Kattegat and Skager Rak, introduced to the accomplished King of Norway, shown over the city and finally started on a long tour through Norway with its fields, fosses and fiords, its ancient Norse cities of Bergen and Trondjheim, its natural tunnels, Snow Mountains, its three grand Glacier systems.

We cross the Arctic circle, visit the once wonderful Maëlstrom, inspect the wholesale manufacture of cod-liver oil at Hammerfesh, canvass the wonderful fishing banks of Loffodens, study the character and customs of the people, spend a day at North Cape and witness the sun complete its full circle "by daylight."

The hard work of the author's journey began at this point, where he left the beaten track, crossed Norway eastwardly into Sweden and then journeyed southwardly to Stockholm, visiting the copper and iron mines, stopping over at Upsala where Odin, Thor and Frey are buried and where the oldest monument of the

Teutonic tongue is found, a copy of the four gospels in the old Gothic language written a thousand years before Gutenberg was born.

After Stockholm, Helsingfors, the Capital of Finland, on the other side of the Gulf of Bothnia, with its old castles and red houses, University and Botanical Garden; latterly made famous by the polar explorations of Nordenksjold, who was born in Finland and is now Professor in the University of Helsingfors.

The descriptions of the "Lapps and Finns" are extremely interesting, mainly because so little is known of them. The whole book is good and will abundantly repay reading.

THE FATHERS OF THE THIRD CENTURY. By Rev. George A. Jackson, 18mo. pp. 211; D. Appleton & Co., New York, 1881. For sale by M. H. Dickinson, 60 cents.

This is the second volume of the Early Christian Literature Primers, edited by Professor George P. Fisher, D.D., and published by Appleton & Co. The first included the Apostolic Fathers and the Apologists from A. D. 95 to 180.

Beginning with a chronological table of the Roman Emperors, Greek, Latin and Christian writers between A. D. 180 and 325, followed by an admirably comprehensive account of the progress of Christianity in the third century, the author takes up the Greek Christian writers, *seriatim*, beginning with the earnest Irenæus and continuing with the zealous and active Hippolytus, the philosophic Clement and closing with the lofty and learned student and orator, Origen, and gives briefly a summary of and extracts from the works of each. Of Latin writers, Tertullian and Cyprian are largely quoted and summaries of their principal works given.

To readers who cannot take the time necessary to study out the earlier history of Christianity, this series will be found exceedingly useful as showing the origin and formation of many of the doctrines of the Christian church. The volumes to follow, so far as announced, are the "Post Nicene Greek Fathers," and the "Post Nicene Latin Fathers."

FAIRWAY AND FOLLY. By James J. Reno; 8vo. pp. 585. Ramsey, Millett & Hudson, Kansas City Mo., 1881. For sale by the Kansas City Book & News Co., $2.50.

This is a well printed and handsomely bound temperance story. The plot is laid, and the materials for the tale found, in one of the interior towns of Missouri, where whisky had gained the ascendancy over the greater portion of the population.

There are many very good things said in the course of the story, and its general objects and aims are praiseworthy, but there is abundant evidence of a lack of experience on the part of the author as a writer. He has clearly aimed too high

in attempting, as his first effort, so large a work. As a writer of short sketches he doubtless would succeed better and probably acquire, in time and by practice, the degree of skill in the handling of his subjects and the versatility of style requisite to satisfy the popular taste in book-writing.

OTHER PUBLICATIONS RECEIVED.

Education in France, from the Bureau of Education, 144 pages octavo; *Ciel et Terre*, a popular Review of Meteorology and Astronomy, published at Brussels, Belgium, monthly; a Cartoon entitled "The Press in Danger," issued by the Anti-Monopoly League; Catalogue of Professors and Students of the State School of Mines of Colorado, Golden, Colo.; Joseph's Coat, by David Christie Murray, G. P. Putnams' Sons, N. Y. 50 cents; Sabbath Observance, Its Origin, History and Significance, by William Emmette Coleman, San Francisco, Cal.; Report on the Restoration of American Shipping in the Foreign Trade, San Francisco, November 15, 1881; Addresses of Hon. Geo. B. Loring, Commissioner of Agriculture, and Prof. C. V. Riley, U. S. Entomologist, at Cotton Convention, Atlanta, Ga., November 2, 1881; The Longitude of the Morrison Observatory, Glasgow, Mo., by Professors J. R. Eastman, U. S. N., and H. S. Pritchett, of Washington University.

SCIENTIFIC MISCELLANY.

WESTERN ARTISTS.

BY MRS. M. W. HUDSON.

"Western Artists!" the *æsthete* will exclaim, "Preposterous; there are no western artists. This country is too new. Artists keep near to centers of art and wealth." What, then, shall we call these dabblers in water-colors and oils who wear *sombreros* and oil-cloth coats, and carry camp-stools and sketch-books over the Rocky mountains the year round?

The sojourner in that vast region can hardly go amiss of one or more of these picturesque individuals on either a summer's or a winter's day. They swarm to this great open picture-book of nature in the warm seasons, and many remain to study the mid-winter "effects." Denver is full of studios, and hundreds of wealthy people from the eastern States, who visit the mountains, take home with them paintings for which they pay from twenty-five to five hundred dollars, each, or they give an order to a resident artist for a view which has especially pleased them, or they designate the kind of picture they desire; that is,

whether it shall be a near, or a distant mountain view, whether water, or rocks, or foliage shall predominate, whether it shall be romantic or beautiful—and have it sent after them when it is finished. This making of pictures to order is an extensive business in Colorado, and, if no better, these paintings are at least no worse than the shiny daubs of the "Palisades," "Lake George" and the "White Mountains," by "New York artists," with which cheap picture stores and street-peddlers have flooded the West for so many years, and it is the purpose of this rambling chat to defend, in a measure, the right of these western painters to the title of "artists;" a better right, at least, than the painters of most of the pictures which are brought to the West from the East by dealers.

Their strongest claim to the title lies in the fact that they are doing their best Comparatively few of the Rocky Mountain students are painting by the square yard for a living. Hundreds of them are inspired with the idea that they are "born" artists, that some day their works will be sought for and exhibited, and, best of all, paid for at a high price. Of course a majority of them will paint themselves out in a few years, but western people need not sneer at them as a class on that account, for there will be found among them comparatively as many real artists in ten years from now as there will be successful merchants among the many who are embarking in that pursuit, and it may result quite as much to the enviable fame of the great West if we, as western people, take a little pains to seek out and encourage the promising artists in our midst as to pay our court exclusively to the merchant princes. Of course we are a too practical people to think of comparing art to commerce in point of importance, but if we can recover for a moment from the intoxication of business we will all admit that we are in danger of crowding everything else out. And if we soberly reflect, we can conceive that Art was once young, even in Greece, and that it required the worship of a whole people to elevate it to the noble place it finally reached there.

It is worth while for any one who goes to the Rocky Mountains, and to Denver, to visit the *ateliers* and note the difference in the work of the numerous aspirants for fame. To be sure his feelings will be wounded when he sees the great canvases of some boy-painter who thinks he has caught the translucent atmosphere of a twilight or a day-break that is almost as subtle as the human expression, and that none but a Turner can mimic, and he will turn discouraged from the great bald rocks that look as if one might lay a hand on them and leave a deep imprint, as in putty, while the sky above them seems as hard as the bottom of a baking dish; but if he perseveres he will come upon a bit of cañon, or a burnt-pine mountain side with a new growth of quaking asps fringing its feet, or a snowy peak with a cool sky behind it, that will astonish him and please him greatly. He will say to himself, "After all there are some pictures here." And if he is at all picture-wise he will conclude that the best way to secure a satisfactory *souvenir* of the mountains is to seek it in the studios of Colorado Springs or Denver.

The bare idea of leaving an order for a painting is conclusive evidence to the artist that his customers know nothing of pictures, and he fills the order from a furnisher's stand-point, not from an artist's.

To persons who admire and intend to buy, but who do not pretend to critically judge oil paintings, this hint will be valuable. A view of distant, snow-crowned mountains with sunset clouds behind them will never be satisfactory, and the longer one owns and studies such a picture the less satisfying it will become, that is, if it is prized as a mountain view. If it was bought for the clouds, it may be worth the money, though that is doubtful. The sunset hues of clouds and peaks in Colorado could not be outdone in vividness by any brush, it is true; neither could they have even justice done them by any brush in Colorado, hence they were better not attempted; but furthermore the warm colors of a sunset background bring the mountains so near that their immensity and majesty are necessarily lost. No perspective can overcome a red and yellow sky sufficiently to make a white peak drawn against it seem "miles and miles away." The only thing that can in a measure overcome the effect of these warm colors in a "distance" is the Moran haze. It would, perhaps, be more nearly correct to say the Turner-esque haze, for it is well known that Thomas Moran was a close student and a copyist of Turner's works, but as Moran is so well known in this country, though his two large paintings in the Capitol, at Washington, as the greatest artist who has ever attempted, Rocky Mountain scenery, and since his style has been clumsily aped by so many amateur landscape painters, is it not allowable to speak of the Moran haze? The writer has never seen his "Grand Cañon of the Yellowstone," nor the "Chasm of the Colorado," having never visited Washington City,—a confession which almost every American who has traveled at all should blush to make,—but all who have seen even one of his smaller pictures understand what is meant.

To the unpracticed eye this haze is very beautiful, but unless it is made by an artist it will soon be discovered that there is no picture behind it, that instead of looking through a visible atmosphere at an outspread landscape, one is really looking through a very gauzy veil hung before a hard wall.

After having looked at a great many pictures by western artists, the conclusion was very plain that if one wished to secure a picture of the mountains that would give the best idea of distance and height, he must select a clear, cool sky. If mists are attempted, let them be earthly, not heavenly. It should not be necessary to say that unless a purchaser knows when a picture is well drawn he runs a great risk of wasting his money, but no class of persons understand better than artists themselves, that thousands of pictures are bought every year in Colorado by persons who really know nothing about pictures, and that thousands of paintings are sold every year by "artists" who really know nothing of art.

But after one has gone the round of western artists' studios, examined their work, been pleased and disappointed by turns, with mountain, plain, glen, waterfall, sky and foliage, he will ask, "Where among them all is our coming American Landseer or Rosa Bonheur?" "Why have we not one among us who can

people his mountain fastnesses with the picturesque and graceful elk, deer and antelope?" If the American buffalo is not immortalized soon, whoever does it will have to take the "Last of the Mohicans" for his model.

The great opportunity open to a young American artist is to make an animal painter of himself, or herself, and although this little article is modestly addressed to amateur picture buyers, and not to artists in any sense, this suggestion is open to appropriation by any one worthy to take it up.

THE RISKS OF THE ELECTRIC LIGHT.

BY PROF. HENRY MORTON.

The sources of danger in the use of the electric light are essentially two; from the conducting wires and from the electric lamps. As long as the electric fluid or electric energy is conveyed by a sufficiently good conductor it is perfectly harmless, resembling a river flowing in its natural channel and powerless to rise above its banks; it is only when some easier channel into surrounding objects is offered, or some partial obstruction of a certain character impedes its regular flow, that trouble may arise. The conditions of these difficulties are, moreover, very peculiar. Thus, for example, if two electric conducting wires, forming the outgoing and returning paths of a powerful current, are placed near each other, but are separated by a bad conductor, as for example, when both are tacked onto a board partition wall, the current will follow the wire from end to end, with no development of heat in the same or tendency to leave the conductor or pass into any adjacent object. If, however, between the two conducting wires we introduce some imperfect conductor, such as a small wire, some metallic dust, or a film of water containing mineral matter in solution, then a portion of the current will be diverted into this "short cut" from wire to wire, and may heat the wire or metallic dust or the wood wet with the aqueous solution, so as to cause the ignition of inflammable matter. Accidents of this nature have already occurred. Thus a telegraph or telephone wire having fallen across one or more of the conductors used for street-lighting purposes has been fused, or, itself escaping, has caused the fusion of finer wires connected with it.

Again, two wires, being the outgoing and returning circuits of a powerful current, have been nailed side by side, without other insulation, on the same board of a floor, partition, or ceiling; and though used safely for a long time, while the wood-work was in its normal state, have developed a very dangerous activity when the wood between them was wet with dirty or impure water. In that case the water offers a circuit through which a cross current is established which first heats the damp wood, then chars it, and finally establishes a series of of minute arcs or electric sparks along the charred surface, which would soon develop a conflagration if left uncorrected.

Again, two such wires as above, insecurely attached near each other, may be brought into momentary contact and then separated, in which case an electric arc, with its intense light and heat, will be established between them. In like manner a conducting wire itself may be insecurely connected at some point, and if the abutting ends are separated slightly during use, a similar arc with its intense heat may be there developed.

Turning to the dangers which might be expected from the electric lamp, it is to be remarked, in the first place, that these in the case of the arc lights depend much upon the number of lamps operated on the same circuit. Thus, if thirty or forty lamps are operated in series, the electro-motive force of the current must be sufficient to maintain a corresponding number of arcs; and therefore if by any means many of these arcs are closed out, the electro-motive force of the current available for the remaining ones would be so excessive that their arcs might become excessively long, and even the metallic carbon-holders and other parts of the lamps constitute poles between which the arc would spring, melting the metal-work and establishing a very dangerous system of combustion.

To avoid this class of dangers, two provisions should be made. In the first place some arrangement in the lamp itself by which, whenever the arc exceeds certain safe limits, the current will be automatically diverted from it and carried through a good and sufficient conductor; and, in the second place, some apparatus in connection with the electric generating machine by which the electro-motive force of its current should be varied automatically in correspondence with the resistance of the circuit, so that any diminution of such resistance, as by the closing out of several arcs, should cause a corresponding diminution in the force of the current generated. Numerous contrivances for both of these purposes have been already carried to greater or less perfection and efficiency, and it is manifestly possible by such means to secure immunity from risks of this sort.—*Sanitary Engineer.*

EARTHQUAKES OF 1881.

Among the remarkable things for which 1881 will be long remembered are its earthquakes. Not since the memorable years 1811 and 1812 has there been such a wide circle of terrestrial disturbance as now exists. Seventy years ago nearly the whole western hemisphere trembled under the strain of internal commotion. But the area in which the earthquakes were felt was bounded by the two great oceans, and neither Europe or Asia suffered to any extent. The present area of commotion seems to have no limits. Reports of violent earthquakes have for many months past come from every quarter of the globe. The shocks that desolated Chios in April rank as agents of destruction with the earthquakes which destroyed Lisbon in 1755, Riobamba in 1797, and Caraccas in 1812. The recurrence of earthquakes within a few days at Chios which have again caused the inhabitants to flee for their lives, the shocks experienced at Agram

two or three weeks ago, and the recent shakings of the ground felt in New Hampshire and other places in the country, indicate that the disturbing forces are yet active in widely separated portions of the globe. In fact, the history of earthquakes show that when once a wide circle of commotion has been established, several years must pass before the internal forces exhaust themselves. The earthquakes that began in 1811 lasted until 1813. They were very frequent in the Mississippi and Ohio Valleys, and north of Cincinnati the shocks occurred for months at the rate of twenty or more a day. The farmers became so accustomed to them that they hardly stopped to lean on their hoes while an earthquake was shaking the corn-fields. This recalls Humboldt's account of his experience in South America in the beginning of the present century. He traversed regions in which earthquakes were so common that the inhabitants no more thought of taking account of their number than Europeans think of counting the showers of rain.

One of the most interesting things about earthquakes is their tendency to group themselves into periods. The present earthquake period began three or four years ago, and some supposed that it had reached its culmination last fall when Agram was overthrown. But the shocks increased in force until the terrible disaster at Casamicciola occurred in March last. This, in turn, was supposed to be the climax of a series of violent terrestrial commotions that, beginning in Peru in 1879, within a few months circled the earth. About a month later, however, came the great Chios earthquake, one of the most destructive on record; and this so far remains the crowning disaster of the present earthquake cycle. But the return of the shocks at Agram, and the indications of continued commotion in various parts of the earth show that another calamity of the same kind may happen any day.

Ordinarily, earthquakes are confined to countries in the neighborhood of volcanoes. But in periods of unusual activity, like the present, they sometimes occur in places where they are least expected. In the valleys of the Hudson, the St. Lawrence, the Ohio and Mississippi, shocks have been felt this year. Exactly what relation exists between volcanoes and earthquakes men of science are trying to find out. It seems to be settled that they both result from the same general cause. Whether the whole interior of the earth is a molten mass (a theory that has fallen out of favor of late), whether it contains reservoirs or pockets of molten rock under volcanic districts, or whether the phenomena of volcanoes or earthquakes are the result of some force not yet understood, makes little difference except so far as knowledge of the facts may enable science to master the laws that govern terrestrial disturbances. The significant fact, however it may be explained by theory or observation, is that the ball upon which we live, instead of being a dead, inert mass, a type of stability, is heaving under the strain of interior forces, which, though too insignificant, so far as human observation goes, to produce outbursts comparable to those in the sun or some of the larger planets, yet suffice at times to overthrow great cities, to burst mountains asunder, and to destroy at one stroke many thousands of human beings.

Scientific men have attacked this problem with admirable courage. Observatories have been erected on the banks of Vesuvius and Ætna, where the breathings of those monsters are carefully recorded, and skilled observers have been stationed in several of the earthquake centers of Europe and Asia, armed with ingenious instruments. If, as some prophesied, the present cycle of earthquakes is to last for several years, it is not impossible that we may be on the eve of discoveries that will enable us to foresee and prepare for the shakings that Mother Earth occasionally gives us.

Capt. Mallett, of the bark Cherokee, of Liverpool, which arrived here on Saturday, had an unusually interesting story to tell. Besides encountering severe gales in his voyage, he says he and his crew felt the effect of an earthquake at sea. At about six o'clock in the afternoon of August 6th, when they were nearly in the middle of the Atlantic, and about in the latitude of the northern part of Newfoundland, two severe shocks made the bark tremble from stem to stern. The shocks were between five and ten seconds apart. Capt. Mallett says that in his long experience as a seaman this is the first time he has ever felt an earthquake shock at sea, but he has been informed that such shocks have been felt by vessels in the South Atlantic near the Equator.

Dispatches from Chios say that the earthquake shocks in that island have been renewed within a few days, and that one village seems to be sinking. The inhabitants are deserting their houses in alarm.—*N. Y. Sun.*

GLASS AS A BUILDING MATERIAL.

Perhaps not one builder or contractor in ten, if told that the common grades of glass made at the glass factories in this city have a crushing strength nearly four times as great as that credited by experienced engineers to the strongest quality of granite, would accept the statement as true. Yet it is fact, and being so, the query as to why glass has not received more attention from architects as a structural material naturally suggests itself. A reporter had a talk with several prominent glass manufacturers on the subject, and in answer to an interrogatory as to whether blocks of glass could be made in suitable lengths and sizes and so annealed as to be utilized in the construction of a building in place of stone, they said that it could be done. Said one of these gentlemen: "This question has been considered by myself a number of times and, although I do not want to advocate the absolute abolition of brick and stone, yet in the erection of art galleries, memorial buildings, etc., a structure composed of blocks of glass in prismatic colors would be a unique, beautiful and lasting structure. With the numerous inventions which have come into use of late years in connection with the production of glass, the cost has been gradually going down, while the quality of the fabric is steadily becoming better. Now, as the Smoky City controls the bulk of the glass production, there could not be a more appropriate place for the erection of such a building.

One objection which would be raised to the durability of a glass house, in the literal sense of the words, might be that the blocks would not take a bind, or adhere together with common mortar. This objection can be readily set aside by the use of a good cement, and when completed the structure will stand for ages, barring extraordinary accidents or mayhap cataclysm. As to the cost of a glass house, it can be kept down to but a small percentage above the price of cut granite, as there are many points where saving gains can be made. Thus, for instance, in building with stone you have to pay the stone masons, and when it comes to elaborate examples of carving, in Corinthian pillars, collars and capitals, etc., why, the work is rather costly as compared with glass, when the latter can be molded into any shape or form, and the work accomplished in much less time. I am convinced that the time will come when we will see such a building erected. Scarcely a day passes but what the sphere of glass as an article of use becomes widened.

In parts of Germany, and on one line in England, glass ties are being used on railroads, and thus far have given satisfaction, combining all of the requisites of wooden ties with the virtue of being susceptible to usage at least seventy-five per cent longer than wood. Then by the Bastia process, glass articles are now being made for common use which can be thrown on the floor and will rebound like a rubber ball. Progress is also being made toward rendering glass, which has even been characterized as "the brittle fabric", ductile, and to-day threads of glass can be made that can be tied in knots and woven into cloth. Were one disposed to give play to fancy, and fuse it into fact, a house entirely composed of glass could be built with walls and roof and floors fashioned from melted sand. Carpets of glass could cover the floors, the wall decorations embodying the forms and colors of the most ultra æsthete, sitting on glass chairs or reclining on glass couches, arrayed in glass garments, eating and drinking from glass dishes, such an one could realize that the age of glass had come. Yet nearly all of this, fifty years ago, would have been classed with the then impossible telephone and electric light, and this statement would have likely found its place in the catalogue "expurgatorus."

Much has been said about the inability of modern glass manufacturers to make window glass imbued with the rich and beautiful colors peculiar to the windows of old cathedrals in England and on the Continent. It is not generally known, however, that the secret of securing those wondrous tints has been discovered by one of our glass manufacturers. After a long series of experiments conducted in conjunction with Mr. Thomas Garfield, of Boston, a cousin of the martyr President, he has found that the rich effects in those old cathedral windows are owing to the poorness of the quality of the glass. Owing to the imperfect mixing of the ingredients by the old glass-makers, the substance did not unite closely, and in consequence it became porous, and the minute particles of soda in the composition are exposed and act in the function of radiators, which give brilliancy to the colors of the window. In making window glass in colors,

now, the makers prefer to leave the surface rough, in order that by exposure t the elements it may go through the same beautifying process alluded to above.— *Pittsburgh Dispatch.*

THE GARDEN OF THE GODS, MANITOU, COLORADO.

BY WILLIAM ALLEN BUTLER.

Beneath the rocky peak that hides
In clouds its snow-flecked crest,
Within these crimson crags, abides
An Orient in the West.

These tints of flame, these myriad dyes,
This Eastern desert calm,
Should catch the gleam of Syrian skies,
Or shade of Egypt's palm.

As if to bar the dawn's first light
These ruby gates are hung;
As if from Sinai's frowning height
These riven tablets flung.

But not the Orient's drowsy gaze,
Young Empire's opening lids
Greet these strange shapes, of earlier days
Than Sphinx or Pyramids.

Here the New West its wealth unlocks,
And tears the veil aside
Which hid the mystic glades and rocks
The Red man deified.

This greensward, girt with tongues of flame,
With spectral pillars strewn,
Not strangely did the savage name
A haunt of gods unknown.

Hard by the gentle Manitou
His healing fountains poured;
Blood-red, against the cloudless blue,
These storm-tossed Titans soared.

Not carved by art or man's device,
Nor shaped by human hand,
These altars, meet for sacrifice,
This temple, vast and grand.

With torrents wild and tempest blast,
And fierce volcanic fires,
In secret molds, has Nature cast
Her monoliths and spires.

Their shadows linger where we tread,
Their beauty fills the place:
A broken shrine—its votaries fled—
A spurned and vanished race.

Untouched by Time the garden gleams,
Unplucked the wild flower shines,
And the scarred summit's rifted seams
Are bright with glistening pines.

And still the guileless heart that waits
At Nature's feet may find,
Within the rosy, sun-lit gates,
A hidden glory shrined;

His presence feel to whom, in fear,
Untaught, the savage prayed,
And, listening in the garden, hear
His voice, nor be afraid.

—*Harper's Magazine for December.*

BRAINS AND INTELLIGENCE COMPARED.

The brain is universally recognized as the organ of mind, and the size of 's organ is very generally taken as an index of mental capacity. Big brains ve come to be suggestive of great minds, while it is an undoubted fact that the ssession of a brain which falls below a certain minimum standard of weight im- es idiocy on the part of its unfortunate possessor. M. Broca places the lowest ıit of brain-weight compatible with human intelligence at thirty-seven ounces males and thirty-two in females, the average brain-weight in Europeans be- ; about forty-nine ounces. Whether the possession of more than the average antity of brain implies the presence of more than average intelligence is a ques- n that has given rise to much discussion. It is an undoubted fact that very ;h brain-weights are occasionally found in people whose mental acquirements : certainly not above the average. Out of 157 brain-weights of adult Scotsmen, . Peacock found that four, all belonging to artisans, who, so far as could be rned, had not been distinguished among their fellows by superior intellectual lowment, weighed over sixty ounces each, while the heaviest brain on record t weighed sixty-seven ounces—belonged to a bricklayer. Dr. Morris, who

chronicled the case, was told that the man "had a good memory and was fo of politics, but that he could neither read nor write." Whatever his potentialit might have been, "it is evident," says Dr. Morris, "that his actual acquireme were not great." The non-development of superior mental power in such cas may, however, be attributable not to lack of capacity for learning, but to the a sence of the conditions necessary to its growth. Certain it is, that among the e ucated and intelligent classes, the number of big brains is greater than with une ucated and less intelligent people. Among the latter the proportion of bra weights above fifty-five ounces has been ascertained to be only from four to s per cent, while the proportion among men who have been distinguished for gre intellectual acquirements, is at least twenty-three per cent.

The brain-weights of only twenty-three such men are accurately known, a it is from these that the above proportion has been obtained. With few exce tions, these were all above the average capacity of forty-nine ounces. First this respect comes the celebrated naturalist Cuvier, with a brain-weight of six four and a half ounces, followed by the famous Scottish physician, Abercromb and the poet, Schiller, each with sixty-three. Goodsir, the anatomist, follows a considerable distance with fifty-seven and a half, Sir James Simpson with fif four, and Chalmers with fifty-three. That such men as Gladstone, Bright, et possess more than the average brain-weight may be inferred from a statem lately made public of the size of hat worn by these and a number of other livi or recently deceased statesmen and literateurs. Premising that what is kno to the trade as size seven is that of the average head, with presumably forty-n ounces of brain, and that seven and three-eighths is a size so large as only to be ma when specially ordered, it appears that out of fourteen persons whose hat-si are given, two (Lord Chelmsford and Dean Stanley) were below, while oth (Lord Beaconsfield and the Prince of Wales) were exactly up to the average. the others, Dickens, Selborne, and Bright required seven and one-eighth; F Russell, seven and one-fourth; Lord Macaulay, Gladstone and Thackeray, se and one-eighth; Louis Philippe, seven and three-fourths, and the Archbisho York, eight full. Of the twenty-three distinguished men already referred whose actual brain-weights are known, four, including the late Prof. Hug Bennet, and Hermann, the philologist, are distinctly below the average, showi as Dr. Bastian points out in a recent work, that "a well-constituted brain small dimensions may be capable of doing much better work than many a lar organ whose internal constitution is, from one cause or other defective." W there is no such defect, however, the big brain, there is every reason to beli confers an undoubted advantage on its owners.—*Edinburgh Scotsman.*

THE MISSING LINK.

A reporter of the *Philadelphia Times* has been interviewing Professor E. D. ope upon the descent of man from animals of the monkey tribe, and gives the llowing account of the statements of the Professor. Exhibiting a part of a di-inutive skull not larger than the skull of a small ground squirrel, he said:

"It came from the valley of the Big Horn River, in Wyoming Territory, ıd is the upper part of the skull of a species of the marmoset monkey. It was und in the lowest eocene layer of the tertiary formation, and as for its age, I n hardly say. The years, however, run back so far that people who think this new country would be considerably surprised if they knew the figures.

"This skull is remarkably similar, in miniature, of course, to the human ull. The brain space is remarkably large, and is, in fact, several times larger an the brain space of any of the skeletons of animals of the same period of time. ıe characteristics of the formation of the human skull are clearly defined, so early as to be remarkable. The teeth are almost the same as human teeth, ile the jaw has many strong points of similarity. I consider this skull as the rliest indication of the existence of man. It is a new species of a familiar class, d has hitherto been unknown to scientists. The connection between man and is animal, it seems to me, must have been very close, although, of course, nine en out of every ten would raise a dispute. No animal at that time, except this culiar species, had a head like that of a human being, and the brain space, ntrasted with the brain space of other animals, or even of the monkeys of to-y, shows a vast superiority of intelligence.

EDITORIAL NOTES.

[T]HE lecture of Dr. Edwin R. Heath before · Kansas City Academy of Sciences, in vember, was well attended and gave great asure as well as instruction to his hearers. s own personal part in the discoveries de along the Beni River having been destly suppressed, it was almost unani-usly demanded by those present and will given some time this winter. Dr. Heath also consented to give three lectures be-e the Scientific Club, in Topeka, very n. At the December meeting, held on 27th ult., Professor J. M. Greenwood, of city, read a paper in reply to the criti-as of Charles Francis Adams, George A. Walton, Richard Grant White and Bishop McQuaid on the public school system. It was an exhaustive review of the whole subject, showing careful study and ample reflection.

THE snow-plow invented by Mr. Osborne, of this city, bids fair to prove a success. In brief, the improvement consists in introducing a system of steam pipes between the mold-board and sheet-iron cover and keeping them hot from the engine boiler. When the plow enters the drift the snow is melted rapidly and such as does not melt is compacted together firmly at the sides of the track.

A PATENT has recently been taken out by gentlemen interested in this city for reducing to solid extract the *Polygonum Amphibium*, (Swamp Smart-weed,) for tanning purposes. This plant grows most abundantly in the swamps and low grounds of the West, and its tanning properties have long been known and utilized in a limited way, but it is not generally understood that it is far superior to oak or hemlock bark for the purpose. Professor Samuel Aughey, of the Nebraska State University, found 17.01 parts tannin in 100 of the dried tops, and 21.02 in 100 of the rhizomes or underground stems, while oak contains only from 6 to 10 per cent and hemlock still less. We examined some samples of calf-skin that had been immersed in a solution of this extract for only thirty days and which seemed to us perfectly tanned. The material is not only naturally abundant, but is easily cultivated, so that it need never become scarce nor dear, and there seems to be no reason why an immense and successful industry may not be put into operation right at home, to the advantage of all classes of citizens.

ON the 25th of November some defect in the machinery of the elevator at Meyer Brothers' store caused the car, which was loaded with sulphur in barrels to fall from the fourth to the basement floor. When the car struck the lower floor the barrels were bursted open by the concussion and the sulphur took fire. The question is, what ignited it? If, as is generally believed, it was the result of friction between the car and the iron check-ways, we must suppose that these irons were heated to redness, since sulphur does not ignite at a temperature below 560°, while iron shows dull red at 400°. It is more probable that the wooden frame-work of the car was ignited by the friction and communicated the flame to the sulphur.

PROFESSOR F. HAHN, of Leavenworth, Kansas, in proposing a new coal shaft at that place and basing his calculations upon the experience of Major Hopkins in sinking that at the State penitentiary, gives the sum of $30,282 as a very close approximation to the actual cost of reaching a workable vein o coal with citizen labor. The vein at the pen itentiary was reached at 713 feet, and i twenty-one inches in thickness; estimated t yield by June, 1882, 6,000 bushels daily. A Rosedale, Kansas, the shaft sunk by Capt Ira Harris is 326 feet deep and the vein i 21 inches thick. This shaft cost but abou $15,000. With these successes before u there is no reason to doubt that similar re sults would follow mining for coal at thi city; and with coal at ten cents a bushe which Prof. Hahn estimates to be one hundre per cent profit to the owners of the mine, a impetus would be given to manufacturin that nothing else could give.

THE recent news from the Jeannette show that Prof. Towne was not far out the way i his article in this number of the REVIEW upo the probabilities of her safety, when he pre dicted that Capt. DeLong might emerge fror the Arctic basin by way of Spitzbergen i 1882. It appears that he had made nearl as much of the northwest passage as Nordi skjold did when his vessel was caught an crushed by the ice about three hundred mile northeast of the Lena River, in Siberia, an almost due east of Spitzbergen.

The total value of the product of the twe ty-two field crops raised in Kansas, in 1881 is $91,910,439.27, or more than 30 per cer greater than in any previous year in the hi tory of the State. The two that contribut the largest share of this immense total ar wheat and corn; the former making $21,704 275.80, and the latter $44,859,963.29.

WE have received from the mayor an town clerk of Plymouth, England, a ci cular announcing the intention of the peop of that city to erect a monument to the mem ory of Sir Francis Drake, who left that pla on the 15th of November, 1577, on his ev memorable voyage around the globe. It a worthy object, and all English speakin people should gladly avail themselves of tl opportunity to contribute to it. Subscri tions may be sent to the treasurer or to Cha F. Burnard, Mayor.

In the lower portion of the State of Delaware is a swamp from which for many years past cypress logs have been taken out by shingle-makers at a depth of some fifteen feet below the present surface, which is covered with a thrifty forest of a later day.

Dr. J. F. Snyder, of Virginia, Ill., in an article upon the Burial and Resurrection of the great Indian Chief, Black Hawk, in the St. Louis *Republican*, closes by saying: "The conviction is daily gaining strength that the race of Indians found in occupancy of this country when it was discovered by the Euro- eans were the people, or the immediate de- cendants of the people, who built the nounds, and students of American archæol- gy now agree that mound-building was prac- iced by some of the tribes down to a com- aratively recent date." We doubt whether rofessor Putnam or any other first-class au- hority will endorse this statement without onsiderable qualification.

It is announced that a French engineer, I. Selibot, has discovered a method of using ulphuric acid in the reduction of ores of the recious metals, and, what is very essential to s practicability, a mode of recovering the cid after its evaporation. The process is to e tried in Denver in a practical form shortly.

In addition to coast line warnings the Sig- al Service Office has devised a system of ilroad notifications, to be employed by lines aversing districts subject to "Northers," warning other roads of the approach of ich storms. Much good may be accom- ished in this way, as road managers thus otified will have time to prepare for the ow-storms which at present so completely ralyze their operations. We presume that en'l Hazen's experiences on the great plains the West have suggested this plan to him.

Professor F. J. Baker, of the M. E. Col- ge, Baldwin City, Kansas, sends his holi- y greetings in the shape of a renewal of s subscription to "your most excellent and me most interesting Review."

The city of Aurora, Ill., forty miles west of Chicago, is lighted by the electric tower plan. The system consists of six electrical towers, made of iron rods and net work, each one hundred and fifty feet high. They are crowned with electric lamps of two thousand-candle power each, or equal to one hundred and twenty-five gas jets. The cost complete for each tower and apparatus is about $1,000.

Mr. F. Siemens proposes to adapt toughened glass to the manufacture of street lamp-posts, water-mains, and other articles usually made of cast-iron. His claim for glass is that it is stronger than iron, it is imperishable and incorrodible. The profit to the maker will be twice that of cast-iron, but the specific gravity of glass is so much less than that of cast-iron that the consumer will be able to obtain articles at about thirty per cent cheaper than cast-iron.

The Committee on Instruction and Lectures, of the Academy of Natural Sciences of Philadelphia, announces that the course of instruction in Natural History, inaugurated last Spring, will be resumed during the coming Winter, commencing in the first week of January, 1882. The plan of instruction will be similar to that pursued in the first course, and will consist of Lectures and Practical Demonstrations in the Laboratory. Twenty-five to thirty lectures, upon "Physiography and Invertebrate Paleontology," will be delivered by Professor Angelo Heilprin. The course of instruction in Mineralogy will consist of about twenty-five lectures, to be delivered by Professor Henry Carvill Lewis. Admission to either of the courses may be obtained by application to the Recording Secretary, Dr. Edw. J. Nolan, Hall of the Academy, 19th and Race Sts. Terms, $8.00 for each course.

Dr. Edwin Ground, of Linton, Indiana, writes thus encouragingly of the Review: "It is arranged in a convenient, practical and concise manner, and is a journal, not for the professional scientist alone, but for the intelligent of every class; being adapted to the widest range of readers of any Science Journal with which I am acquainted."

MR. ALEXANDER AGASSIZ is credited with the very truthful remark that "the pupil studies Nature in the school-room, and when he goes out of doors he cannot find her."

ITEMS FROM PERIODICALS.

THE Beloit (Wis.) *Outlook* says of the REVIEW: "This interesting Western monthly is well advanced in its fifth year and is becoming better and better."

MR. W. E. HIDDEN has recently announced, through the *American Journal of Science*, the discovery by him of emeralds of good quality and in considerable quantity, about sixteen miles northwest of Statesville, in Alexander County, North Carolina.

A NEW college magazine, entitled *The Missouri Univrrsity Review*, will be started in February. 1882. It will be edited by Dr. S. S. Laws, President, with Professors McAnally, Thomas and Blackwell, as associate editors. The first volume will consist of five numbers, issued in February, April, June, October and December, devoted chiefly to educational matters in Missouri. The names and well-known ability of the editors are a sufficient guarantee of the high standing this magazine will occupy in the educational field. Subscription price, $1.00 per annum. Address, *Missouri University Review*, Columbia, Missouri.

THE "Concepts and Theories of Modern Physics," by J. B. Stallo, will be soon published by Appleton & Co., as a volume of the popular *International Scientific Series.*

FOWLER & WELLS, publishers of the *Phrenological Journal*, are just sending out a profusely illustrated volume entitled "Phrenological Miscellanies," comprising some 450 pages, made up largely from articles which have appeared in the *Journal.*

THE *Literary World*, E. H. Hames & Co., Boston, is a fortnightly review of the best new books and, from the care and just discrimination with which its articles are written, should be in the hands of every librarian and book buyer in the country. Large quarto, 32 pages; $2 00 per annum.

PROFESSOR R. A. PROCTOR'S new scientific magazine, *Knowledge*, is said to have secured a very large circulation already in Great Britain, and on the continent. It has not yet traveled as far west as Kansas City, where the Professor has so many admirers.

MAJOR LAUER, of the Austrian engineers, has for some time been using a new method for blasting rocks under water at Krems on the Danube. The chief feature of his system is the employment of a hollow cylinder, like a gas-pipe, to place the dynamite cartridge on the surface of the rock which it is desired to shatter. The dynamite is exploded by means of electricity, and the effect is said to be greater than that of the usual cartridge in a hole bored in the rock, and a saving of forty per cent is effected over the old system.

C. LLOYD MORGAN, F. G. S., in an article on "Miniature Physical Geology," in the December number of the London *Journal of Science*, calls attention to the process of fossilization which may be seen in progress in the blown sand on Mount's Bay. This blown sand, composed of sand and shell fragments, in process of time covers up such scrubby vegetation as lies in its path. This vegetation rapidly decays and is as rapidly replaced by lime, taken up from an aqueous solution of the shell fragments, until a complete cast or pseudo-morph is formed which in many cases preserves the exact form, even to the most minute filaments, of the decaying root or branch.

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GEOGRAPHY.

EXPLORATIONS IN IDAHO AND MONTANA.

BY PROF. E. L. BERTHOUD.

In 1878 I made an extended exploration of the Territories of Idaho and Montana. This included not only the instrumental part of a thorough railway ;urvey, but also a critical examination of the natural and artificial productions of hat region embraced between British America, on the north, and Ogden, Utah, ›n the south, and from the head of the Yellowstone River on the east to the valey of Hell Gate and Wisdom River on the west, a region we found replete with he most interesting natural scenery and the most striking objects that it has ever ›een our fortune to witness.

Without undue egotism, I really believe that our varied, rare and beautiful cenery, for a full exhibition of all the abnormal phenomena of fire, air and water, ıis portion of our republic, exceeds any similar extent in any other region under ıe sun. Montana Territory is a land full of wonders, and, with Idaho Territory, ıey seem to form an area of surface where the former energies, so potently exertd in past geological ages, have not yet found a rest. The cosmographers and hilosophers of the Middle Ages were wont to ascribe many phenomena, many ɜognostic facts, to the "plastic effects of Nature," as if the earth had in itself ›me free-agency power to control its phenomena. Were this so, they could

have found some color for this fancy in the variety of natural objects of nature's energies so liberally found in these two Territories.

Idaho Territory is a veritable "Phlegræan Field." My unknown friends of the Academy can imagine a vast flat plain, covered from the foot of the mountain ranges of Eastern Idaho for several hundred miles west with an uniform close covering of sage brush—the *Artemisia tridentata* of botanists, or, as the Canadian voyagers three quarters of a century since called it, "*absinthe*." This gives an uniform dull gray tint of inconceivable melancholy to what in other respects would often be charming and picturesque. From this plain, formed wholly of lava, covered with a thin coat of sand, and still scantier stratum of vegetable soil, which, however, is generally absent, and nothing grows upon this sterile surface but cactus and artemisia.

The lava plain of Idaho is seamed in a few places by some unimportant streams, the major part of them emptying into Snake River, or its main affluent, Henry's Fork. Aside from this, universal drouth prevails, and 90 100ths of Idaho is doomed to eternal sterility. Universally, all the rivers and smaller creeks flow in deep crevices in black honey combed lava, abounding in rapids and deep pools of cool, clear water, and in magnificent trout. Snake River, the main southern branch of the majestic Columbia, has cut out its bed in this dark lava. It is a fine deep river, swift, impetuous and dangerous. The American Falls, some seventy miles below Fort Hall, are stupendous and magnificent. Here the whole water of this magnificent stream is precipitated down a step in the lava field over 140 feet high.

In the course of our exploration, when surveying our return line by the valley of Madison Fork and Fire Hole River, we left the last named stream on our left, and to avoid its steep and tangled cañons, we prolonged our line of survey over the main Rocky Mountain range by Raynolds' Pass to Henry's Lake, the source of Henry's Fork of Snake River. From this lake we turned sharply eastward, crossed the Rocky Mountains by the Tahgee Pass, 7470 feet above the sea, and reached Fire Hole Valley and the marvelous geysers of the National Park by an easy natural wagon road.

Fire Hole River, from the west edge of the National Park to the several geyser basins, flows through a valley cut through lofty, picturesque, but ragged trachyte mountains, covered with scrub pines, with glades interspersed, clothed with scanty grass. The first cañon in the National Park is grand and weird, seamed with traces of recent volcanic action. Its wildness was rendered more salient from our continued watch night and day to prevent surprise from small bands of hostile Indians driven eastward by Gen. Howard's campaign against the Piutes and Bannocks. With some labor, and by vigorous exertion, we carried our line of reconnoissance up to the Upper Geyser Basin, our wagons being the second only that had penetrated to that point.

I confess that my ideas are barren and my mind bewildered by the amount of objects that three days exploration of that extraordinary region developed. We were then in the first days of October. Before reaching the geyser region

hard frosts at night, and a temperature one morning to zero Fahrenheit, rendered our couches on the volcanic soil cold and restless. Once, however, in the midst of this region of subterranean fires and lakes of scalding water, we felt no more the cold chill of the lower valleys. A soft moist air in the day, foggy mists, or columns of steam, rendered more visible from the greater coolness of the atmosphere, made our mornings enjoyable by their novelty. In the pines, in the open prairies along Fire Hole River, we could see the steam rising from myriads of scalding springs or clear basins of scalding water. Occasionally a magnificent column of steam and boiling water would rush aloft swiftly and play from one to ten minutes in duration. Old Faithful, the Giant, the Giantess, the Castle Geyser, the Beehive, the Fountain, and a countless host of smaller spurting fountains made it difficult to follow any determined course. Everywhere—above, below, around—the hidden energies of subterranean forces were manifest. When near some of the more active vents—some of the more demonstrative *safety-valves* they might be called—we could hear the smothered, labored pent-up groans, or what one would imagine were the desperate struggles of some cavern full of struggling life striving to escape. We stood, as it were, in the mythological Hades; we wandered in imagination on the banks of Cocytus.

> "Cocytus, named of lamentations loud
> Heard on the rueful stream."

The whole ground surface in the geyser basin seems to be made up wholly from the varied mineral deposits of the countless myriads of hot springs. We notice in every direction a peculiar resonance when we ride or drive over the ordinary surface. We seem to wander over a dome erected over immense subterranean lakes of pent-up steam and boiling water. At the surface, the general boiling point varied from 199° to 200°. Dr. Peale, however, (who was then in the Park,) informed me that a self-registering thermometer shoved some fifteen or sixteen feet down the geyser orifices gave him a temperature of 209°, evidently due to an abnormal compression having in these subterranean reservoirs raised the boiling point.

The National Park is well worthy of that title, and for future time its capabilities and its surprising natural phenomena will always render it of most extraordinary interest. I can say but little of the fauna and flora of the National Park. Elk, moose, deer, antelope, mountain sheep, bears, wolves, wild cats, lynx, rabbits and porcupines, with some beautiful foxes, were all we obtained. Birds were scarce, and of only fifteen species, including an abundance of ducks, geese, swans and sage-hens. We were too late for summer flowers, and generally the whole of the sylva of the park consist of pine, red fir, spruce, one species of cottonwood, and ever-present quaking aspen; scrubby willows and some insignificant bushes of Rhus and Cornus complete nearly the whole list.

Completing our surveys in the Park, we turned to the west again, reached Henry's Lake, and tried to follow the west side of Henry's Fork to Snake River. Baffled in this, we traveled westward to Camass Creek, reached the regular stage

road at Beaverhead Cañon, and finally reached Fort Hall and Portneuf River October 19–20, 1878.

During this whole journey I made continued examinations for archæological relics, but had very little success until we reached Upper Madison Fork. Here and around Henry's Lake, Henry's Fork and Beaverhead Cañon, and on Market Lake and Snake River, I gathered some very characteristic obsidian implements which I transmit to the Academy for illustration.

I have always understood, until within a few years, that the presence of obsidian weapons in Kansas, Colorado, Nebraska and Wyoming, and in Utah also, was due to the probable intercourse of exchange from the Indians, or we may say Astec races, of Mexico, with the more northern tribes. I am satisfied that whatever obsidian arrows, lance-heads and leaf-shaped implements I have found in Colorado, Wyoming, Nebraska, etc., were more probably derived from the Yellowstone and from Snake River rather than from New and Old Mexico. Obsidian implements begin to abound from Great Salt Lake northward; and on Portneuf and Snake and Henry's Fork of Snake River, in the National Park, and on Madison Fork its abundance everywhere, both wrought and unwrought, ceased to become extraordinary or noticeable. I have been assured by reliable, trusty residents of Idaho and Utah Territories that even to this date, not farther back than fifteen to twenty years ago, they have repeatedly seen the Bannock and Snake Indians of that region make themselves arrow-heads of obsidian, beautifully and skillfully worked out of flakes, by a simple process of slow clipping on the edges by means of a buckhorn tool, with a cross notch, holding the flake in a piece of buckskin so as not to cut their hands on the fresh, sharp edges of the obsidian flake.

In the National Park Prof. Hayden's parties found a gorge in the mountains which is almost entirely formed of volcanic glass; they have aptly named it Obsidian Cañon. Here, evidently, the material has been used from time immemorial for flaking and conversion into implements. The most common form I have found was leaf form, some of them as much as five or six inches long and well proportioned. Some arrow-heads of obsidian, unfortunately lost in the mountains, are beautifully and regularly worked, and one especially was as if made only a few days before, as it retained an edge and a point as keen as a razor.

The antiquities I have noticed and examined on Madison Fork, extend along the river for three or four miles. These consist of large rings of stones generally rounded and water-worn. Some of them surround low mounds now scarcely one and one half feet high, as if an old wall around the mound. These were mostly noticed about twenty miles southeast of Virginia City. Going south from them about one and one half or two miles, and in the open bottom lands on west side of the Madison Fork, we found a singular series of remains, the use of which it is difficult to conjecture. These remains generally follow the edge of slight step or terrace, of which Madison Valley offers numerous examples that extend for miles on each side as regularly as if artificially constructed. The remains are small piles of stones set at regular distances, sometimes connected by

low cobble-stone wall now all in ruins, and noticeable only from their regular ridge-like form. Occasionally we find stone circles, stone mounds, though very small, but all regularly disposed on an uniformly conceived plan. In Idaho Territory we found some low stone mounds on the top of numerous high hills and mountains, but they represent no present use, except to mark signal stations, or occasionally a lone grave covered with the surrounding detritus and rounded boulders.—*Proceedings Davenport Academy of Sciences.*

THE LOST JEANNETTE.

At the meeting of the Boston branch of the United States Naval Institute, Saturday, Lieut. C. P. Perkins, of the Alliance, which ship went in search of the Jeannette, read his paper on the cruise, as asked for by the Institute. In alluding to the Jeannette, he spoke as follows: Whatever may be thought of the advisability of sending the Alliance into those waters in search of the Jeannette, subsequent events seem to have shown the wisdom of the proceeding, if for no other reason than a general knowledge of ice affairs in the Polar basin. When, on reaching civilization, news was heard on board of the Alliance of the high condition of the ice on the opposite hemisphere, the theory, or supposition, immediately adopted was that the whole Polar ice mass had moved over this year. Such a low condition of ice in the Atlantic has not been known before for forty years. Since this is the first year that Wrangel Land has been circumnavigated, it seems quite safe to say that the ice has never been so high on the opposite side. Is it not fair evidence that the mass has moved? While in contact with the ice during the entire month of August about Spitzbergen, the water temperature was never below 33°. Pools of water could be seen in the floating ice; snow and ice were melting on land, forming huge streams, running down the mountain sides. It is safe to say that miles of the ice was disappearing daily, and yet the place occupied by it was taken by other ice from the north.

In 1827 Parry made a sledge journey to the north from Spitzbergen, hoping to reach the pole. That journey, commenced June 21st, must have been similar to the one undertaken by the Jeannette party this year. Going over the same grounds many times he succeeded in making 100 miles by water, and 192 miles over the ice in thirty-one days, a total of 292 miles. Unfortunately the ice was drifting south all the time, so that the distance accomplished from his base of supplies, the Hecla, was only 172 miles. The height of latitude was 82° 45′. Where does this ice come from? It seems to me the question can be best met by the answer that it is by the drift of the entire ice mass. It is my impression that the northwest current found by the Rodgers and Corwin is the commencement of a vast one, which, going to the north, is deflected partially by the current to the east, found by Nordenskjold close to the continent, and continues in a northwest direction, taking the ice with it until it strikes Franz Josef Land, when it is deflected still more to the right, meeting Spitzbergen on the northeast

coast, and, with whatever force it may have left, it escapes, assisted by the south current, on to the coast of Greenland, into the waters of the Atlantic. In other words, I believe there is a current in the Polar basin, acting in the direction of the hands of a watch. A reason for this impression is the fact that around all islands there is such a current, even to small detached islands, and all of the known ocean currents follow the same direction. Under this impression, I suggested that, though probably caught in the ice, the Jeannette had been probably carried to the northward and westward, and that, finding this current, DeLong would, if forced to leave the ship, raiher avail himself of its benefit by striking over toward Franz Josef Land than work against it by going to Siberia. The loss of the vessel in the given position affords some support to the theory, and the length of time taken for the boats to reach the main land, and the route supposed to have been taken by them, still more. The shortest distance to the main land from their position when crushed was 300 miles, hence an effort would be made to take course. Making their landing at the mouth of the Lena shows they were carried to the westward, and the length of time consumed, nearly 100 days, to my mind, is proof of a northerly, indeed, a heavy northerly drift. The distance of the scene of disaster from Franz Josef Land is only about 900 miles, and I venture to say that that 900 miles, with a well outfitted expedition, could have been made in at least the same, if not a less, number of days.—*Boston Herald.*

TIDINGS FROM THE POLAR EXPLORING COLONY IN LATITUDE 81 DEG. 44 MIN.

LETTER FROM DR. OCTAVE PAVY.

It will be remembered that Dr. Octave Pavy, United States Army, formerly of St. Louis, and who left Washington, D. C., for the Arctic regions on the Gulnare, in June, 1880, (which subsequently returned,) remained in Greenland until the arrival of the Government expedition under command of Lieut. Greeley, U. S. A., in July, 1881, which Dr. Pavy joined as Surgeon, U. S. A, and naturalist, at Godhaven, July 22nd, and with which he proceeded to Lady Franklin Bay, the future station of the signal party, and the base of operation for the land exploring party of which he is a member.

The many friends of Dr. Pavy in St. Louis—particularly the members of the Academy of Sciences—will perhaps be pleased to learn through a brief summary, of the coincidences and results of more than a year's abode in icy Greenland, and of the hopes, more fully counted upon by his past experience, for the coming year's journey toward the pole.

The Government has made the initiatory move toward Arctic colonization, by the establishment of this party on the shore of Discovery Harbor, Lady Franklin Bay, in latitude 81° 44′ and longitude 64° 45′ W., to which selected

spot, as a signal station, a relief party will be sent each succeeding year in the early summer, taking new and well-fitted men to be substituted for those who may desire, for any reason, to return. Thus has been begun a bold attack upon the North Pole, which, for being yearly and methodical and slow, will, it is the thought, be the more powerful and sure in the end.

Senator Conger so wedded himself to the interest of this expedition last year as in a great measure to have been the instrument of its success. In his honor the place at which the house is built by the explorers, at Lady Franklin Bay, is called Fort Conger. It is believed by the friends of the expedition that the $300,000 promised as next year's appropriation will be granted and a new expedition sent off as early as the last. In this behalf it is urged as now more probable than at any earlier period that the Pole will be neared first by Americans, who with such steady and bold endeavor will not admit of final defeat.

Following the last news of Dr. Pavy, written in September, 1880, and communicated by the *Globe-Democrat* in January, 1881, was a letter written at Godhaven, (Disco Island,) Greenland, April 15, 1881, and sent by a Danish vessel via Europe, from which a few extracts of sentiment or travel have been obtained, as also some from letters of later date up to the return of the Proteus in September, 1881. "At last," writes the Doctor, "after eight long months of silence, which has remained unbroken by a word from the South world, where our interest and affection lies centered, we are expecting a vessel from Denmark which will bring truly according to song, 'tidings from afar.' How often, when perhaps 100 miles from any human inhabitant, in the desert of the Arctic, driving my Esquimaux dogs and sledge over rough and dangerous ice, surrounded by cliffs and precipices of death, I might truly say, have I become totally oblivious to these wild, almost unearthly, desolate scenes, and amidst cold, and snow, and piercing wind, have suffered my mind, always warm with imagination, to carry me back to the sunny South and St. Louis. In the dark days I have seen dark hours, mentally, for it is all but superhuman to conquer the melancholy power of a six-months' night, upon even the most buoyant spirit. Amidst the heat of this mental battle I have received almost a material comfort and ease of mind during the worst hours of anxiety, in reflecting upon what the end will be toward which the aggregate of these dark hours and unhappy fates will tend—a glorious gleam of scientific knowledge from out the darkness, which will light up a long unknown history of the Arctic North, and even enhance to me what is now most beauteous, the land where all is sun and light and civilization—the enlightened South.

"The sun so long obscure is climbing higher at this date, the days are waxing longer, and within a few weeks we will have news from that dear land where our hearts, if not our ambitions are. To us it has been an oft-repeated question, What has passed in the world during these months? Will any expedition be sent to Greenland for our aid or otherwise? What has been the fate of the gallant DeLong and the Jeannette? There is a feverish desire for news, which, in other regions where distractions and diversions are, cannot be conceived of. It is almost the fever of disease which would seem to bear itself into medicinal avenues

for treatment. The Governor, the Inspector, their assistants and the humbler Danes, all are thirsty for the arrival of the Danish vessel."

The Greenland settlements are very much alike, and consist of the residence of the Danish Governor or chief trader in the interest of Denmark, a large storehouse where the oil, skins, furs, eider-down and other products of the country are exchanged for the commodities sent out by the Danish Government. The Danes are open-hearted, good people, and are especially kind to Arctic travelers, so many of whom they have known as to be thoroughly versed in the history of travel in Greenland.

During every spring nearly everybody is attacked with influenza or pneumonia. This is a very interesting time to study the native, his habits and diseases, and the necessary modes of treatment, peculiarly moderated or intensified to suit this climate. This yearly spring epidemic spreads frequently over all the districts that have communication with Godhaven. It is believed to be brought by the whalers. Many Greenlanders die of it. Apropos to the term I have just used, little is known of the estimate put upon the word Esquimau by the natives themselves. They suppose that we use it to symbolize what is savage and cruel and uncivilized, and object seriously to the use of the term, and both prefer and use the name Greenlanders.

Practicing medicine as a matter of course, in Greenland, is simply a gratuity, but becomes a friendly *sesame* to the inner life and confidence of these simple but good people. The natives are much opposed and truly stubborn in regard to the use of medicine. On one occasion I insisted that some must be taken, when I was offered the same and perhaps the only encouragement the Esquimau could offer in the reply, "Well, doctor, how much will you pay me if I take it?" The Esquimau has quite an eye for beauty if in colored or pleasing forms. The Inspector's wife, a Danish lady of European education, on an occasion of a return from a pleasure ride, asked her maid who had her children in charge, to hold and carefully preserve a bouquet of flowers she had gathered to present her husband. The maid admired them exceedingly and a little later was asked why she had thrown them out of the boat. Her answer was that they were beautiful and that she had not thrown them away, but had eaten them. This was a devouring admiration of her kind, but not fully appreciated by her mistress. During the light months I made frequent visits by sledge travel to various places and settlements of interest.

My longest sledge journey was a circuitous one of 750 miles, taking in the settlements of Godhaven, Rittenbank, Egedismundi, Proven and Upernavik. I was drawn over the ice by about eighteen dogs and one companion—an Esquimau. We had some severe mishaps and many self-denials and wretched meals, at one time breaking through the ice and having to abandon a sledge and to find a new, which proved to be a long, winding route toward Godhaven. My cheeks became badly frozen and remained black for some length of time.

When I desired a new guide or any assistance one was furnished me most readily and generously, who had to drag his own sledge, too, through the unceas

ing hummocks of ice. In all my travels I had constantly the main object in view, to gather supplies of all kinds for the coming United States expedition, of which I had word through European mail. I was collecting dogs, sledges, clothes, dog food, or gaining promises for the same, and so far won the friendship and confidence of the Esquimaux who could be useful to an expedition, as to have obtained in advance their promise to go as guides whenever I called for them after the expedition arrived. This premature work will certainly be of incalculable value to our expedition in point of time saved, as it will doubtless be a necessity for them to hasten toward Lady Franklin Bay, not only that they may reach there themselves, but that the ship may return to the States before the ice could close them in; hence there would be little time for search of provisions, dogs, natives, etc.

I will have by the date of the arrival of the ship all that can be collected or promised between Godhaven and Upernavik. I have had a quantity of clothing of the warmest and best fur made for myself and the sledge party who will be exposed to the rigors of winter by sledge travel. I crossed the Strait of Waigat, about thirty miles. It separates the main coast from the Island of Disco. After camping one day on the shore of the island, on account of the weather, which was too rough for a whale-boat, I proceeded toward Godhaven, where I expected to await the coming United States ship. This strait is peculiarly striking and has heretofore been grandly described by another.

After leaving this poetical spot we pulled to the oars all night, and in the morning, while turning a point about two miles from Godhaven, saw the three masts of a ship, and very soon the smoke-stack appeared. We gave three cheers for the American expedition, which we were certain this must be. An hour more and I was aboard—after a long, dreary year, once more with companions from home—with letters in hand, gifts spread before us, fast-repeated messages and greetings, making din and confusion about us. Few will have known the joy of such a meeting and such awful gloom and dreariness of abode and heart.

The Proteus surprised me in its early arrival, as it will every one conversant with the ratio of travel heretofore in this region. McClintock, in search of Franklin, was detained a whole year by ice in this locality, and scores of whalers and expeditions have been lost or delayed fatally at this point. The Proteus had been waiting for me two days, while I expected to have several days or weeks to await her arrival after this date. This trip is a good proof of the progress which can be made by persistent effort in overcoming certain seeming retrogrades, because of disappointment of season and unfavorable ice, which must, and is proved, will be favorable at times, and can then be taken advantage of (as in this case), if science is seeking the open *sesame* every year, regardless of discouragements and past failures.

After reaching the Carey Islands two parties went ashore, myself and Lieut. Kislingbury, to the cairn erected in this island, the most southeast of the group. Commander Greeley and Lieut. Lockwood walked along the shore to the depot of provisions, placed here at the same time by Capt. Nares, of the English expe-

dition of 1875. The novices of the party were quite astonished to see "red snow" on shore, which, in this case, was not very crimson, but by this time a common sight to me.

Soon after passing Cape Alexander, which, with Cape Isabella, forms the entrance to Smith's Sound, we found ourselves at Lyttleton Island. An officer and myself with some of our men started for "Lifeboat Cave" in the whaleboat, about eight miles in the distance, but from the clear sight of it, seeming, as usual, to be very near. At this point Buddington and part of the Polaris party passed their second winter after the death of Capt. Hall. We found several relics of the Polaris' camp and took pleasure in sending them to some of the party now in Washington. At Cape Hawkes, while Commander Greeley and an officer went ashore to inspect the rations deposited here by Nares, I went with Lockwood to Washington Survey Island, which lies opposite. We were obliged to separate, after much difficulty in landing at all, because of overhanging "ice-foot." I took the west end of the island and Lockwood the east. We had to climb to the top of a summit.

On the top of that which Lieut. Lockwood mounted he found the Nares cairn and the record inside. He took the original and left a copy, with also a record of the Proteus' movements. We found the ship getting under way when we returned breathless and fatigued by our necessary haste.

When we were off Cape Lieber, about Cape Baird, which makes Lady Franklin Bay, we found the ice of impenetrable character, and were obliged there to halt. Commander Greeley and myself went ashore at Cape Lieber. The high cliff that forms this cape is almost perpendicular on the side facing the sea, and is about 2,500 feet in height. From this point a grand view was before us. Polaris Promontory, the entrance to Lady Franklin Bay, Petermann's Fiord, Bessel's Bay, all like a panorama of grandeur in variety of proportion, spread before us. It was also where Hayes opened his eyes upon the open polar sea. The cairn he mentions having erected could not be found. The ice, which, was so dense as to wholly impede our further progress one day, upon the following left the way clear to our travel through the influence of a strong southwest wind, which always has the same effect.

Soon after this most fortunate occurrence we were at Lady Franklin Bay, in Discovery Harbor, and prepared to raise the house upon a spot to be called Fort Conger, which is the first signal station of the colonization party, and the future headquarters of many land-exploring parties.

Every man, with unwonted energy, assisted in unloading the Proteus, that she might the sooner return south.

The photographer of the expedition, and the jovial man of our party, seems to have had quite an unusual visit in point of time and interest to the hut of a native Esquimau, who lived in the primitive style. His description of the same is worthy of the quotation I ask of him for the *Globe-Democrat*, my home paper "At Proven a better opportunity for studying the habits of the primitive Esquimaux was afforded than at any other place we have visited. The whalers and

:xploring parties seldom visit it, and the influence of the white man is less per-:eptible. They retain their habits of life as practiced before the general condi-ion of the race was improved to a great extent in other parts of Greenland. I pent four hours consecutively in one of their least attractive 'igloos' or huts.

"My pretext for so protracted a stay was ostensibly awaiting the completion of a cap of eider-down, on which one of the squaws was engaged. The hut was uilt of turf, moss and stone, and was entered by a long, narrow, low passage or unnel—so low that I was compelled to crawl on hands and feet, a most disagree-ble and humiliating proceeding, as the dogs and natives (not much better in oint of cleanliness) also have ingress and egress through the same vestibule. On eaching the small interior hole which was the entrance to the living, eating and leeping-room, the first glance revealed the mistress of the house, in an extremely iry costume, sitting on the shelf or platform on which they sleep. By due pro-ess of barter a neckerchief that I had worn was transferred to the possession o he squaw in exchange for the eider cap to which I referred, and which she at nce proceeded to make, first measuring the dome of my intellect with great pre-ision.

"The room was too low to admit of standing upright. No stove or fire-place ppeared; as a substitute there was a hollowed stone, used as a lamp, with seal-oil or fuel and moss for a wick. The atmosphere of the room was stifling and ex-remely nauseating from the odor of seal-skins strewn around. The sleeping ar-angements were most simple—a platform about two feet high and extending om the wall about six feet occupied one side of the room. This is the recepta-le of skins and furs during the day, and when the natives retire they make it a eneral couch, each disciple of Morpheus drawing over himself or herself so any of the skins as are necessary for comfort.

"The costume of the Esquimaux women is so nearly like that of the men at at first glance it is difficult to distinguish the sexes. The women, however -as all the world over—dress in a more pleasing manner than the men. The ostume generally consists of a pair of dainty boots of dressed seal-skin, stained ifferent colors and ornamented with small pieces cut in fancy forms, which :ach above the knee.

"Then come the trunks, or pantaloons, also of seal-skin, but with the long air on. This garment is very short, reaching hardly half way down the thigh, hen they meet the boots or leggings. The upper part of the body is covered y a loose-fitting cassack or smock, devoid of buttons, which is pulled on over e head. An attached hood can be drawn over the head or allowed to fall back 1 the shoulders at pleasure. A pair of the afore-mentioned trunks, or panta-ons, was the only part of the costume which the dusky maker of my cap saw to wear. She appeared to work with greater facility, however, than if tram-eled with clothing, as she deftly held the materials in position with her toes hile she trimmed or fitted them. Two or three children were hanging about r, without seeming to impede her progress in the least. As soon as completed e placed the cap on my head, and proved at once the possession of at least one

quality in common with her more civilized sisters, of being able to flatter by showing in gestures and expressions great admiration, but whether for her handiwork or our appearance we could not determine, but I at once was reminded of the remark of the descendent of Israel: 'It fits you like de paper on de vall.' I was indeed glad to escape from the unfragrant place. The single window was made of the membraneous tissue of the stomach of the seal. This substance when oiled becomes almost as transparent as glass. Many of the natives, however, live in far better dwellings than the one I have described. Such a one represents the habitations of the poorer classes."

During my year's stay among the various settlements as far south as Egedesminde, and north as Upernavik, whether practicing as physician, when I could thus do good, studying to verify my theories of the science of this region of mystery, or traveling over the ice needing aid and companionship from the inhabitants, I have had in every degree the co-operation and constant attention of the Danish Governors and the Inspector of Greenland and the kind assistance of any Esquimaux of whom I chose to ask favor. It would be a difficult thing to stay here for study and travel if it were not for the uniform courtesy extended by the Danish officials. They are gentlemen of more or less European education, and appreciate work done in the interest of science.

It is not necessary to mention the full collection of animals, birds, eggs, specimens of all kinds I was enabled to collect. There is an abundant room for study here. Of the prehistoric age there is a world of interest open to the student. Ethnology is a branch of especial interest to me, and was made, with the study of land formations, coal seams, etc., a subject of devotion and rare pleasure in point of interest. Botany, even, is pleasant and novel, and it gave me peculiar delight to make a botanical collection, because I felt that in that I would have the appreciation of the eye by those at home.

A letter addressed to Dr. Pavy by "Krarup Smith, Inspector in North Greenland"—there are Smiths so far north, it seems—is a tribute by that Danish official to the professional services of the Doctor and his zeal in the northern exploration, for which, he adds, he is well outfitted. It is dated Godhaven, July 1[illegible] 1881, and written in excellent English, as well as perfect in penmanship. The official has a family who lives at Godhaven (Disco Island), and is a man of information, education and politeness. Though his yearly association with explorers who have gone north within the fourteen years of his service there, he is well versed in Greenland travel and Arctic matters in general.—*Globe-Democrat.*

THE LATEST EXPEDITION TO THE LENA.

The Russian expedition to the mouth of the Lena, organized by the Imperial Society of Geography, which left St. Petersburg the 28th of December, will pass a year on the coasts of the frozen ocean. In sending this expedition the Society fulfills the obligation contracted toward the International Polar Commission. The following States take part in the enterprise projected by the Commission:

1. Austria—One station at Jan Mayen Island.

2. England—One station at Fort Simpson.

3. Germany—Two stations; one on the Gulf of Georgia, the other a place not yet decided upon, in the region of the North Pole.

4. Denmark—One station on the western coast of Greenland.

5. Norway—One station at Altengaard, in the province of Finnmark.

6. Russia—One station at the mouth of the Lena.

7. The United States—Two stations; one at Point Barrow, on the east of Behring Strait, the other at Lady Franklin Bay, Greenland; the latter is already in operation.

8. France—One station at Spitzbergen.

There are nine other stations in the Arctic region and two in the Antarctic region. There is every reason to believe that there will be one or two additional Arctic stations. These may swell the list of persons engaged to over 200, all taking active parts in this enterprise, which will cost altogether a million rubles. If it be considered that besides all this the magnetic observations in the more southern regions will be immensely stimulated, the importance and costliness of the enterprise will be fully appreciated.

The Russian expedition will undertake the heaviest part of the work. It will have to traverse about ten thousand versts (6,630 miles) and establish itself in an exceptionally cold region at the mouths of the Lena close to the place where the lowest temperature in the world has been noted. In January the average temperature is 40° below zero, the point at which mercury freezes. The greatest precautions will, therefore. have to be taken to prevent the members of the expedition from losing their lives. It may be presumed that fortunately the survivors of the Jeannette boats, who were living at the end of October, according to the news of them received a fortnight ago at Irkutsk, will have been transported ere this to a more hospitable clime by the people with whom they had taken refuge.

ANTHROPOLOGY.

THE PREHISTORIC COPPER IMPLEMENT QUESTON.

BY PROF. H. A. REID.

In my history of the State of Missouri, published by the Missouri Historical Company, the first chapter is devoted to "Prehistoric Missouri;" and in speaking of the mound-builders I use this language: "They had no knowledge of iron, nor any art of smelting copper; they merely took small pieces of the native ore and hammered it cold with their stone tools until it took some rude shape of utility." After this was published my attention was called to Mr. Conant's state-

ment in a volume which is deemed the classical, or *standard*, history of the Iro Mountain State. This book is the joint work of Prof. Swallow, the veterä scientist of the State University, at Columbia; Col. W. F. Switzler, the learne editor of the Columbia *Statesman;* and A. J. Conant, of the St. Louis Academ of Science. In this work Mr. Conant said of the mound-builder: "It has bee stated, and often repeated, that they had no knowledge of smelting or castir metals, yet, the recent discoveries in Wisconsin of implements of copper cast i molds, as well as the molds themselves, of various patterns, and wrought wi much skill—prove that the age of metallurgical arts had dawned in that regioi at least."

I naturally supposed that Mr. Conant had knowledge of later facts and ev dences than I had, and hence in my article in the REVIEW of November, 188 page 406–7, in speaking of the tiny copper-ax relic which I had found at Lexin ton, Mo., I cited Mr. Conant's statement and presumed it to be correct. Bu in the REVIEW for December, page 490, appears a letter from Prof. F. W. Pu nam, of Cambridge, Mass., sharply criticising my article. I am also in recei of two letters from Dr. P. R. Hoy, President of the Wisconsin Academy Sciences, referring to the matter, and he writes: "The quotation relating molds and cast implements of copper found in Wisconsin is entirely incorrect. have received a note from Mr. Conant in which he says flatly that he was mistake and he could give me no answer as to his proof of the loose statement. * * I think it too bad that such an error should become wide spread."

Prof. Putnam is Secretary and Curator of the Peabody Museum of Arch ology, at Cambridge, Mass., and, hence, ought to be an expert in archæolog which I do not profess to be. But I will cite the essential points of his critiqu and perhaps be able to throw some light on the subject. Prof. Putnam says:

1. "May I take the liberty of asking why he (Prof. Reid) thought the was cast, and not hammered into shape?

2. "Can any one give an account of the molds found in Wisconsin? Wh were they made of, and where are they now?

3. "Every statement of the melting and casting of copper by any peo in North America, outside of Mexico, before European contact, must be tak with due caution.

4. "I have not seen a single object made of copper from these sources th I should regard as having been cast; on the contrary, the evidence of hammerir and rolling between stones, is more or less clearly shown in all by the charac of the surface and by the distinct lamination of the metal in places, when ca fully examined with a lens."

Reply to No. 1. Because it *looked like* a casting; the surface has a free gra ular quality or grainy roughness, just like coarse iron castings molded in sar or the toy trinkets which boys sometimes cast from lead or pewter in a mo whittled with a jack-knife in two pieces of soft silicious shale. It shows no sp dent or mark that looks as if it had ever been struck with a hammer of any so

Again, the surface of fracture shows at least two places that look as if gas or air bubbles had occurred there when it was cast and thus made a weak place which ultimately led to its being broken. And again, there is no "evidence of hammering" from any "distinct lamination of the metal in places," as Prof. Putnam expresses it. The shape is more artistic and perfect than would be likely to be produced by free hammering. These are some of the chief reasons "why he thought the ax was cast, and not hammered into shape."

The specimen was exhibited at the November meeting of the State Academy of Sciences, of Des Moines, Iowa, and the report of that meeting in the *Daily State Register* said: "Prof. Reid exhibited some mound-builder relics, one being a fragment of a tiny copper ax which he had found in connection with fragments of ancient pottery, flint-chips, arrow-heads, etc. This elicited a good deal of interest and was tested with acids by Messrs. Carey and Bailey, who found it to be pure copper. Some thought it had been molded, while others thought it had been hammered out from a piece of native copper."

Reply to No. 2. Dr. P. R. Hoy, of Racine, Wisconsin, in "Transactions of the Wisconsin Academy of Sciences," Vol. 4 page 136, says: "Some of those implements that have been supposed to be cast were, I think, swedged; that is, a matrix was executed in stone, into which the rudely fashioned copper was placed, and then by repeated blows the article would be made to assume *the exact shape of the mold.*" Again he says: "I am persuaded that, in a few instances at least, *there was a complete mold* worked out in halves, on the face of two flat stones, so that by placing a suitable piece of copper between them and giving it repeated heavy blows the copper was *made to fill the mold* accurately." The Doctor then recites at some length how he once found such a mold or "slight excavation on the face of a large granite boulder;" but in attempting to chip it off it was broken all to pieces. And an editorial foot-note to Dr. Hoy's paper says: "Dr. Butler, who was present, has held strongly for the *casting* of these copper tools."

So here we have quite sufficient ground-work for Mr. Conant's general statement; and I remember to have seen articles about these Wisconsin discoveries of *stone molds* and *molded copper implements* going the rounds of the newspaper press two or three years ago. Men on the ground seem to have differed, at least in regard to some of them, as to whether the copper had been melted or worked cold; but, in either case, it is admitted that molds were used.

Reply to No. 3. In this item Prof. Putnam himself virtually admits that the pre-European inhabitants of Mexico did smelt or cast copper. And on page 126 Vol. 4, Wisconsin Transactions, Dr. Edmund Andrews, of the Chicago Medical College, says: "They (the mound-builders) were miners and coppersmiths of considerable skill, but apparently wrought their metal solely by hammering; yet they occasionally had *molten bronze chisels*, which they probably imported from Mexico. They possessed shells from the sea, plates of mica from the Alleghanies, and obsidian from the Rocky Mountains. They probably sent copper to

Mexico, for in the graves of Yucatan have been found beads of the Lake Superior chlorastralite."

Again, at the fourteenth annual meeting of the Kansas Academy of Sciences, Prof. Snow, of the State University, gave an account of his own recent "archæological explorations in the Pecos Valley, New Mexico." Among other things he said: "On a hill opposite the church they found specimens of pottery of the most ancient type, and also specimens of more recent origin. In one locality they found *specimens of slag* (the refuse from smelting) and indications of supposed mining shafts. The supposition was that these were evidences of mining by the ancient Pueblos." And on page 481 of the REVIEW for December, 1881, I find Columbus Moise, of Las Vegas, New Mexico, making this statement: "The remains of *furnaces*, and such rude means and vessels as the primitive races used in mining, may yet be found scattered about in many places, showing conclusively the existence of mines which paid, even with their rude methods. All implements found are of either stone or copper; the *furnaces*, of mud and rock."

Now, all this goes to show that not only the ancient inhabitants of Mexico, as Prof. Putnam admits, but also the Pueblos of New Mexico, *melted copper* and made implements of it.

Reply to No. 4. My specimen found in Missouri has the external appearance of having been cast. Prof. Putnam admits that copper was anciently cast in Mexico. Later discoveries, as above cited, show that copper casting was also done in furnaces by the ancient Pueblo inhabitants of New Mexico; and if so, is it not at least possible, and reasonably probable, that it was also done in some other places—in Wisconsin, for instance—even though we may not yet have found any all-convincing proofs on the subject. Some intelligent observers think it was. Moreover, my specimen may have come either from the Mexican or the Pueblo artists, instead of from any kind of copper smithery in Wisconsin. But let it be understood that Wisconsin, or the Lake Superior region, is not the only place where copper exists, for the State of Missouri has plenty of it, and in every variety of ore. It has been found in that State in the following counties: Dent, Crawford, Benton, Maries, Greene, Lawrence, Dade, Taney, Dallas, Phelps, Reynolds, and Wright. And in some parts of the State, especially of the Ozark region, remains of very old mining work and furnaces have been found, which some observers suppose to have been pre-historic, although the majority thus far attribute them to the early Spanish adventurers. It is claimed that some of De Soto's army spent the winter of 1541–42 in Vernon county (southwestern part of the State), the chief evidence being that very old, rude smelting works or furnaces have been found there. But it is just possible that these works may have been prehistoric, the same as those of the Pecos Valley and other places in New Mexico. The archæology of Missouri, like her mineral wealth, is only in the infancy of its development and I quite suspect that prehistoric mining and metallurgy will yet be identified within her borders, in addi-

tion to the two-or-three-centuries-old works of Spanish and French adventurers, to whom it has been the fashion, hitherto, to attribute anything of that kind.

The foregoing article was read at the December meeting of the Des Moines Academy of Science, for criticism, suggestion, or amendment. The copper relic in question was subjected to more thorough examination with various styles of magnifying glasses which were at hand—mostly pocket-instruments, such as physicians usually carry for ready convenience. And the conclusion was practically unanimous that the ax *had been made in a mold*, but by the process of cold-swedging a piece of native copper, and not by melting it. The rough, grainy surface, that looked and felt so much like a casting, was thought to have resulted from oxidation; and the appearance of air-bubbles in the line of fracture was thought to have been an original flaw in the ore.

The next day I took the relic to Dr. E. H. Carter, Dean of the Iowa Electric Medical College (medical department of Drake University), and examined it with a magnifying power of eight hundred diameters. Dr. Carter, who is one of our Academy members, but who was not present at the meeting, first detected spicules of vitreous quartz imbedded in the copper. I afterwards verified his discovery, and also found several others; they were so fine that no hand magnifier would reveal them at all, but under this high power they were as plain as quarry stones; and here was further proof that this piece of copper was pure native ore, which had never been melted by man. We detected also a crease or depressed wrinkle that had been produced by the compression or crowding together of the surface of the metal.

Conclusions.—Out of all this investigation I evolve the following summary:

1. Prof. Putnam's statements and criticisms were altogether too general—were even obnoxious to his own strictures; for he did not discriminate between *free-hammering* and *swedge hammering* or pounding, in the matter of different modes by which our ancient stone-folk worked copper. And he did not discriminate between *molds for swedging* into shape pieces of cold native copper, and *molds for casting* molten copper.

2. If Dr. Hoy reports him correctly, Mr. Conant admitted in his letter more than the case required.

3. The evidence in regard to pre-historic furnace-work is not all in. There are some "connecting links" yet to be discovered.

4. I reverse judgment and correct my error. My copper ax was not cast from melted copper, but was shaped by the process of cold-swedging in a mold or matrix worked into some kind of very hard stone.

DES MOINES, IOWA, December 15, 1881.

OUR POSSIBLE LEMUROID ANCESTOR.

In the January REVIEW we re-published from the Philadelphia *Times*, under the title "The Missing Link," a reporter's statements respecting the recently found lemur *Anatomorphus Homunculus*, from the Wasatch beds of the Big Horn. Naturally these statements were somewhat loosely made, and we gladly copy from the *American Naturalist*, for January, Professor Cope's own description.—[ED. REVIEW:

AN ANTHROPOMORPHOUS LEMUR.—The stock from which the true quadrumana have been derived, is supposed to have been the lemurs, but no type of that sub-order has hitherto been found which presents any near resemblance to either of the four families of monkeys. The two inferior families *Cebidæ* and *Hapllidæ*, agree with most of the *Lemuridæ* in having three premolar teeth, but those of the upper jaw generally have well developed internal lobes like the true molars, while most of those of the Lemurs have none. One group of Lemurs, the *Indrisinæ*, agree with the higher monkeys in having but two premolars, but these also are only one-lobed.

A nearly perfect cranium of a species of *Anaptomorphus* Cope, shows that this genus had but two premolars in the superior series, as in the *Indrisinæ*, but that they are two-lobed, as in the *Simiidæ* and *Hominidæ*. Of these two families, the *Hominidæ* is the one to which *Anaptomorphus* makes the nearest approach in dental characters. The canine is small with a crown little longer than those of the premolars, and is not separated from the latter or from the incisors by any appreciable diastema. All but one of the superior incisors are lost from the specimen, but those of the lower jaw, which I discovered in 1872, were nearly erect as in man and the *Simiidæ*, and not procumbent as in most Lemurs. The cerebral hemispheres are remarkably large for an Eocene mammal, extending to between the middles of the orbits; the anterior parts, at least, are smooth. The cerebellum projected beyond the foramen magnum posteriorly, as in *Tarsius*. The orbits are large, approaching those of *Tarsius*, but are not so much walled in by a septum from the temporal fossa as in that genus. The superior molars have only one internal cusp.

The species, which I propose to call *Anaptomorphus homunculus*, has a wide palate, much as in a man, and the true molar teeth diminish in size posteriorly. The pterygoid and zygomatic fossæ are short and wide, and the petrous bone is large and inflated. The animal was nocturnal in its habits and was the size of a marmoset. The genus is nearer the hypothetical lemuroid ancestor of man than any yet discovered.—*E. D. Cope.*

ENGINEERING.

THE TEHUANTEPEC SHIP-RAILWAY.

Captain Eads' new bill will be presented to Congress very soon with a few important changes likely to render it more acceptable than before. As explained by Capt. Eads himself, these changes are as follows:

"In the first place, in consideration of the guarantee which we ask from the Government, the Ship-Railway Company agrees to transport vessels belonging to citizens of the United States or Mexico at one-half the established rates both for passengers and freight. Secondly, the Ship-Railway Company agrees that if at the end of ten years, it should be found that the earnings of the road will pay more than eight per cent dividends on its capital stock of $75,000,000, the Company will, at the request of the United States Government, reduce its rate of tolls so as to keep its dividends down to eight per cent. Thirdly, the Ship-Railway Company agrees that at any time during the existence of the guarantee (which expires in fifteen years) if the Government elects to guarantee six per cent dividends on the entire stock of the Company, it will carry the ships of the citizens of the United States across the Isthmus without any charge whatever."

He further said in regard to the discrimination proposed between the vessels of the United States and other countries;

"Careful estimates have been made by able experts in England, which establishes the fact beyond question that the cargoes of fully loaded ships can be transported by railways across the Isthmus at seventy-five cents per ton. During the past season from $19 to $21 per ton have been paid as the ruling rates on the grain from California to Liverpool by way of Cape Horn. Some of the owners of the ships engaged in this trade have assured me that they would cheerfully pay $6 or $7 per ton for crossing the Isthmus. The road could make handsome dividends by charging all vessels, except those of the United States, $3 per ton, and half that price on our own ships. The commerce of the world, at that price, would be immensely benefited, while the discrimination in favor of American commerce would act as an immense stimulus in restoring our ocean marine to its former magnitude. I have no doubt that if American commerce were carried absolutely free, $3 per ton on all foreign commerce requiring the use o fthe Ship-Railway, would be amply sufficient within five years after the completion of the road to pay six per cent dividend on its capital.

"If the United States assumes to exert a controlling influence over the American Isthmus, one of the strongest measures it can possibly adopt to sustain such a position will be the prompt encouragement of the construction of an American ship-transit by American enterprise, and in American interest. She cannot maintain the respect of the world at such a period as this if she places any

impediment whatever in the way of Comte de Lesseps without at the same time responding to the universal demand for a passage through or over this great natural barrier to the commerce of the world.

"My visit to England last August satisfied me that every dollar which is required for the work will be subscribed there within sixty days after the United States declines my proposition; but I have no fear whatever of its being declined by the Government. The concession which Mexico has given to me is so comprehensive and liberal that it enables me to give such advantages to the United States as cannot fail to be acceptable.

"The private capitalists who are engaged to-day in England in transporting the immense crops of California and Oregon would construct the ship-railway at once if I would consent to have them control it. Such a result would put the finishing stroke to our ocean commerce. They would have at least the absolute control of the carrying trade between our Pacific possessions and Europe.

"There are very few intelligent people to-day in either England or America who have any doubt as to its practicability. I have received within the last three days from England several letters from the very highest possible authorities upon such subjects, fully indorsing the entire practicability of the ship-railway. One of these letters is from Mr. Barnaby, the present chief constructor of the British navy, another one is from Mr. William John, the chief manager of the ship-building establishment that has just finished the City of Rome, the largest vessel afloat in the world except the Great Eastern; another is from Mr. Pearce, the sole owner of the works which build the White Star steamers. Mr. John was for many years the scientific adviser of the Committee of Lloyd's Register in London, a position requiring the highest possible expert knowledge of the science of ship-building. Another letter addressed to me is from Emmerson, Murgatrayd & Co., the builders of the Bombay docks which were designed to take out the Great Eastern, and which lifted 10,000 tons vertically. They were the builders of the Malta Docks also, and they offered to build the works which I need at each end of the railway on the same terms that those works were built upon, and to lift with absolute safety the largest loaded ships forty-six feet high in thirty minutes, ready for transit over the railway. Another letter sent to me from England is a copy of Sir Edward Reed's reply to the request of Admiral Ammon, of the United States navy, giving his views on the relative merits of the Nicaragua canal and the ship-railway. The letter is the ablest essay in favor of a ship railway that has yet appeared. Sir Edward was formerly the chief constructor of the British navy. He has probably had more experience in ship-building, docking and repairing ships than any man in the world; has written several treatises on ship-building, and has been knighted by the Queen of England in recognition of his eminence. I have other letters from a number of other gentlemen in England equally as distinguished as those whom I have just mentioned, but my proposition to Congress really leaves the question of practicability beyond discussion, for the guarantee which I ask is not to take effect until the practicability of the ship-railway is demonstrated absolutely."

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, Dec. 17, 1881.

Public attention is daily becoming more intensely fixed on the subject of railway brakes and signals. Since a long time specialists have been studying systems of continuous brakes, that is to say, a plan of operating simultaneously on several carriages. It is not a little singular, that from the first, electricity was designed as the agent; as M. Achard, in 1858, proposed an electric brake for the Great Eastern of France. In 1860 Messrs. Tremblay & Martin took out a patent for the employment of compressed air as a motive power to regulate the rapidity of locomotives and railway carriages. The trials were not successful. From 1861 to 1872 efforts were made to group uncontinuous brakes as patented by Newall, Clarke, Heberlein, etc. In 1872 the Westinghouse brake was introduced into Europe from the United States; next succeeded the Smith plan of rarified air. Between these two systems, and neither of which is perfect, engineers had to decide. The Smith patent, which was the Tremblay & Martin idea, possessed the advantages of being simple, had no delicate or complicated mechanism, was easily constructed and repaired. But it had the drawback, that the force exercised by the brake could not exceed the pressure of one atmosphere. In the Westinghouse plan, a greater pressure could be employed, since the agent being compressed air, several atmospheres could be utilized; it also presented the advantage of pulling up more promptly masses of matter animated with a grand momentum. But the fear existed, that the valve which gave passage to the compressed air, was too delicate and very difficult to repair; hence, authorities are nearly divided into two camps, with the balance of the opinion in favor of the Westinghouse brake. However, experience showed the latter could spontaneously get out of order, and suddenly cause a train to come to a full stop; then to resume travelling, it was necessary to undo the brake from carriage to carriage. Further, it was not a *moderateur* check, obedient to the engineer, when descending a decline, etc. Since September last, M. Henry, of the Paris-Lyon Railway, has remedied these defects. A question that the engineering world has yet to agree upon is: Ought brakes to be automatic? The system has the advantage of telling itself, by stopping; but the stoppages arrive so frequently as to counter-balance superiority over the other systems. In France, the leaning is at present decidedly in favor of the Westinghouse, which represents an important progress since twenty years; but where may it be in another score of years?

Closely connected with the solution of assuring the maximum of security in railway traveling, is the question of signals; these must not be only visual, easily read by the driver, but the faithful interpretation of electric signals; they must not be too numerous, in order to afford the means and the leisure to be readily perceived, and not induce undue confidence. Between the look-out for signals and keeping an eye on the line, attention to brakes, and the new system of furnace Belpaire, requiring only thin layers of combustibles, both driver and stoker have serious responsibilities and no small anxieties.

The visual signals are the colored disks and the semaphores with ascending and descending arms; there are also electric signals between each signal post, to indicate when a block of line is free or closed. But they are the first only that speak to the driver's eyes. Efforts are made to marry the two systems, and the accepted idea is, that electricity ought only to be employed to efface, not to make, the visual signals. And despite every perfection in point of view mechanical, and with fairly worked, intelligent and well paid employees, human fallibility will ever exist as the cause of a certain number of accidents. The very perfecting of mechanical contrivances is in itself a danger, as it begets an undue confidence of security. A servant can wire the departure of a train, but forget to display the stop-signal to guide the driver of a following train. The problem to solve is to secure the two warnings by one and a simultaneous movement. M. Lartique. of the Great Northern of France Railway, appears to have succeeded; at a station, the man displays the arm signal to stop, and it is by an electric current from a station further on, that liberates the arm of the semaphore, indicating the train has left and the way is clear. If by chance the electric current failed, etc., all that could result would be a delay in the succeeding train.

Lead-intoxication can be produced by a very small dose of that metal introduced into the system; its symptoms are recognized by intense headache, colic, nervous irritation, pain in the kidneys, paralysis, etc. It seems we live in an atmosphere of lead; it is everywhere present, although invisible. Thus M. Gautier, an authority on lead-poisoning, exhibits that insiduous poison in walls, wool, leather, clothing, water, the siphons for seltzer water, the crystal flacons for Orleans vinegar, in white wine bottles, in tinned food, such as preserved vegetables, sardines, lobster foie-gras, tunn, etc. However, neither the emanations from house-painting, nor the salts of lead employed to prepare leather or dye-stuffs, can be a source of serious danger; in the tins of preserved vegetables, the quantity of lead absorbed is feeble, though the solder contains seventy-five per cent of thct metal. The matter is more serious in the case of sardines or food preserved in oils, or abounding in fat; here oleate of lead is formed and increases in proportion to the time the aliment has been boxed up. The French Government has prohibited the internal soldering of sardine cans, but two years must elapse before the stocks on hand can be used up. In the meantime the French contractors for the navy, have to supply the new prepared sardine boxes. After sardines rank *foies gras* and lobster; the former can be had readily in earthenware

pots; as for the latter, they contain less lead poison than sardines or fat liver. Siphons are only dangerous when allowed to rest on the side, and drinking-water suffers no injury in leaden pipes so long as it keeps flowing.

M. Hement draws attention to the fact, that when the dumb are trained to speak, they do so in the accent of the locality where they have lived; but M. Blanchard denies the fact: there is no *patois*, but a uniformity of croaking, metallic pronunciation; a series of mechanical, muscular efforts, having nothing in common with any known accent, but sufficiently intelligible to be comprehended between the speakers themselves. M. Coeljo, a Portuguese gentleman, asserts that the creoles have *patois* so distinctly peculiar, that it remains ever the same, whether pronounced by a Hindoo, Chinese, negro, or Red Indian.

M. Alphonse Milne-Edward has drawn attention to the resistance of certain animal-germs. In the environs of Paris, after unusually heavy rains or inundations, quantities of crustaceæ, called *apias*, are to be found in old cartruts, hollows, and ditches; dry and warm weather ensues, the water in these places evaporates, the apias disappear, no trace of them can be found till like inundations ensue; then new generations spring into existence, which, too, in time also disappear. Siebold has demonstrated that the eggs of these infusoria could, pending several years, preserve their germinating power. M. Certes, in 1878, evaporated some of the saline water in the province of Constantine, Algeria, and preserved the dry sediment till April, 1881, when he placed the residue in filtered rain-water; soon numerous infusoria were developed, and also several larvæ, presenting all the characteristics of the animalcules peculiar to the water originally taken from the pool. The French Government commissioned M. Alphonse Milne-Edward to execute some methodical dredgings in the Mediterranean, and which he has recently concluded. The results are interesting and curious; specimens of low organizations of life were plentifully discovered at depths of 1100 and 2800 yards: one species was found almost blind, since its eyes were deprived of pigment. At a mean depth of 275 yards, the temperature of the Mediterranean is constant, between 32° and 53° F.; this fact explains the little development of life in the depths of that sea. Further, the Mediterranean is isolated in a life sense from the Atlantic by the Straits of Gibraltar, which form as it were an impassable bar. However, all the beings that occupy the depths of the great island sea arrive from the Ocean. Another circumstance which militates against development of life is the absence of rocks, or the vast depots of sludge which cover them, rendering the conditions for swarming most unfavorable.

Following up these details, M. Blanchard gave explanations, that the Mediterranean is a sea of only recent formation, anterior doubtless to the historic period; indeed he would go the length of saying, its formation progresses still; he confirms the results obtained by M. Milne-Edwards, that life in the abysses of the Mediterranean is tenanted from the Atlantic, but goes on dwindling as we advance to the Orient; he added, that the flora and fauna of the north and south

shores of the sea present analogous or identical species, following not zones of latitude, but those of longitude. The same phenomena is to be observed between Indo-China and the Sound Islands.

M. Quatrefages confirms the opinion of M. Lund, that the fossil man discovered by the latter in the Agna Santa Cavern, is contemporary with the species of mammoths whose remains have been found in bone-caves. In brief, M. Lund holds to the theory of fossil man, and which he maintains every day brings fresh evidence in support. M. Quatrefages himself has made a profound examination of the American skulls in the Natural History Museum, and pronounces they have a form generally analogous with those found in the Agna Santa cave.

M. Palsermacher has invented an apparatus for measuring the "doses of electricity" for invalids.

PHILOSOPHY.

AN APOLOGY FOR NATURE.

BY DAVID ECCLES.

Habits of thought, like habits of dress, are seldom suddenly changed. Most innovations, in inception, appear grotesque, and this fact is the bulwark of conservatism. A certain familiarity must be cultivated before any departure from established modes of action or thought is free from unthinking prejudice. We are all "custom made"—stereotyped in the matrix of our surroundings—and those most governed by antecedents generally least suspect it. Each individual, in the hallucination of an absolute freedom, feels himself above all law, past or present, whereas, his neighbors may observe he moves with the uniformity of an automaton and does all his thinking in an established groove. The electrolysis of social habits polarizes us all, and pre-determines our adjustments. Individual thought is but a small factor of modification; however accurate and true to Nature that thought may be. Predilection for, and pre-adjustment to, the old, makes us unconsciously sacrifice the truths of the new to a spirit of compromise. The evolution of all thought exhibits this tendency, and no department furnishes stronger illustration than that pertaining to law and miracle.

Time was when such a thing as uniformity of action, as applied to Nature, was never suspected. Nature was then as capricious as the caprice of the uncultured mind could reflect it. Gnomes, nymphs, sylphs, fairies, witches, spooks, angels, devils, gods and goddesses without end, filled heaven and earth, to the exclusion of all conception of law. Before physical science was born, "miracle" was the explanation of everything. It is a long way from these barbarous con-

cepts to our present mental altitude, but the connection is unbroken; and here, at least, the evolutionist is at no loss to discover intermediate links. All round him he sees the atrophied rudiments of obsolete modes of thought; while by historic research into the buried strata of forgotten tombs, he exhumes the perfected form in which these now inert rudiments had their functional uses.

A great system of speculative theology, born of the imagination, once filled the vacuum of human thought. Man must theorize; and, when destitute of knowledge, his theories are generally mere figments. In a world of mystery, ruled by mystery, by mystery held in awe, and quickened by the wakefulness of a savage dread, it is no wonder ignorance filled heaven and earth with weird fantasies. The impress of those wild fears is stamped on every living mind. Madame de Stael was once asked if she believed in ghosts. "No," she replied, "but I fear them." It is not difficult to understand the truth of this paradox. We are all heirs to an infinite heritage. Nature, to-day, is a compendium of all that has been. Modes of thought are accompanied in the material world with change of form. Form and memory or mode synchronize. Physiology perpetuates form, and form is indissolubly related to mental function. Therefore, are we all subject to emotions we can but poorly control. Many of us are still disposed to fear darkness and view unusual natural phenomena with a secret alarm. The prophetic end we have been taught to look for is always imminent. Only a few years ago, a comet was a harbinger of war; a meteoric shower a prelude to the final catastrophe, and an earthquake an overture to the day of judgment. Either of these phenomena to-day, in an aggravated form, would awaken the old alarm, even among the educated. We have the intellectual conviction of law, but without permanency as a mode of thought. It requires habit to secure us in the possession of any mode. If we rely on the energy of new thought to balance our actions we are doomed to disappointment. This requires coercion; while acts or thoughts secured by habit, are, in a measure, spontaneous.

The truth of this proposition finds daily confirmation. Most educated people give intellectual assent to the doctrine of law and uniformity in Nature. In diseases within man's skill to eradicate or modify; in catastrophes within our power to prevent; in all ordinary measures looking to material ends, we show decided confidence in natural sequence. But let an appalling and uncontrollable pestilence occur; subject us to a devastating scourge of chinch-bugs or grasshoppers; let there be an unusual and calamitous drouth; and an immediate stampede occurs to the old habit of thought, led off by the ignorant, but followed by all save a few philosophers. Prayer, which in times of intellectual and emotional peace, is used simply as the channel through which men find spiritual blessing, and would be considered a degradation of its use if made a means of asking material wonders, suffers complete reversal under the dire necessity of the situation. As one laboring under pain will try all sorts of exploded nostrums, that peradventure he may find relief; so, when humanity have exhausted all their power, it is but natural that they seek the protection of the Great Mystery behind the veil of phenomena.

The old conception—which extended to diseases and disasters now subject to human skill—that these things are sent as a token of Divine displeasure for man's sinfulness, is openly avowed; although, were this same explanation offered in any individual case of an analagous nature, during ordinary times, people would smile at the simplicity of its perpetrator.

Had Garfield suffered only a flesh wound, no one would have prayed for its supernatural cure—it would have been relegated to Nature and the doctors; bu the terrible hopelessness and helplessness of the situation buried from sight the heartless conception of law that the aching heart might hope in the face of the inexorable and lovingly confide in the power of the supernatural to remove im pending woe. Alas! with all his worth, Garfield was no more in the sight o Nature than the lowest man that breathes; and the sequel is instructive to those whose thoughts follow the line of law.

It is true there are many empiric means of cure, and it does not become us to say that prayer may not be one of them. As a fact, however, we might ques tion whether this is established, save in cases where prayer acts as a direct caus through known mental laws. During the "women's crusade" on the saloons praye effected to close a great many—but through the ears and sympathy of listeners Among the Mormons I have seen many cases of restoration from sickness throug prayer and anointing with oil. The virtue of the oil was questionable, the fer vent faith of the patient being the chief working cause. It has been remarke that the morality among children is greater among the Mormons than elsewhere and some claim this as the fruits of polygamy. Whatever influence this may ex ercise, I am persuaded the chief cause is owing to the fact that in Utah it is con sidered a lack of faith to send for a doctor. Having witnessed the restoration c adults through the "laying on of hands," they attribute the cure to the Elders intercession with the Creator, and expect the same result to follow when the pray for children. But a child cannot exercise faith, the remedial element—hence prayer, broken from the chain of causation, is unavailing, and thousands are ser to an untimely grave. Faith, within the radius of the nervous system *under ce tain conditions* is a working power, both curing and inducing disease, but outsid of this radius it appears to be wholly inoperative. The means by which th mind effects molecular transformation in body tissue is unknown; but it could n more act without the nervous system than a man could communicate with an al sent friend without mail facilities or telegraph wires, and the probabilities are th the modes are somewhat analagous. Prayer enters as a direct cause in fillin spiritual needs. "Blessed are they that hunger and thirst after righteousness, fo they shall be filled," is the expression of a natural law.

Physical science is slowly cultivating a habit of viewing Nature, subjectiv and objective, from the stand-point of law. Hence, in scientific circles, he wh aims to teach is expected to conform to this method, let his opinions be what the may. The supernatural is being merged into the natural, itself expanding in th minds of men by the operation. Its infinite height and depth no man has fatl omed. Habitual experiences of constancy engender habitual laws of though

hilosophy, which is a co-ordination of all science, has taught us the true sphere ' science and the impotency of the human mind in dealing with subjects be- ɔnd this sphere. Science is limited to proximate causes Teleology here finds self a trespasser. "First causes" are born of mental weakness, and are used ıt to cover a vacuity of thought. The mind cannot think beyond the condition- l, and any term borrowed from the conditioned applied to the absolute is a con- adiction and contains the germs of its own destruction. The moment we pred- ate change, succession, time, thought, number, relation, will, etc. of the Infi- te, that moment we make it less than this by reducing it to finite comprehen- ɔn. Thus, a recent writer defending miracles says: "Prayer effects a change the first link through God himself, and thus a corresponding change through e entire chain." A "first link," a last effect, intermediate motion, wrought in ne and circumscribed in space! As a full complement to the thought we only ed to add an anthropomorphic God, and the hypothesis is extremely simple. ven facts to support it, and we might allow that it had scientific worth; but we ould never allow that it in any way approached the depth of an ultimate solu- n. Beyond this being circumscribed in time and space, we would be tempted erect a greater.

Within late years philosophy has taken gigantic strides. The great discovery the conservation and correlation of force has wrought a revolution in the ɔughts of men. The persistence of force, and the indestructibility of matter is fulcrum on which logic has placed its lever to raise man into something like ational being. The energy of the universe is a fixed quantity. It may change place, or change in mode, but in all changes it exacts equivalent for equiva- t. Every event is the product and recompounding of the changing energy of ceding events. There is never a broken link in the chain, and never a *termi-* cause. How can we, as Scientists, claim causation for anything if we eman- ate the entire realm of volition from its domination? The force of the will is ɔecies of catalysis that liberates the stored energy of the system. A keg of ıamite in front of a loaded cannon, connected with a fuse, and this in contact ı a piece of dry phosphorus, can be made to liberate an almost incalculable rgy by simply a breath of warm air. Like this, the will is moved by feeble ses, and liberates energy apparently out of proportion to it cause, but is er uncaused. The direction of all changes is in the line of least resistance. n has no will superior to this law. Spirit, spontaneity, and uncaused causes, in the light of modern science, mere fictions. It is a demonstrable scientific that every effort of thought or will has its mechanical equivalent. The ıght we think, if not identical with, is at least dependent on the energy we ve from our food, and is measurable in these terms. Hence the will or ıght of man has no power over Nature that Nature has not previously given. as the poet says:

> Nature is made better by no mean
> But Nature makes that mean;—

Over that art which you say adds to Nature,
Is an art that Nature makes.

The philosophic mind can no longer conceive Nature as a machine runn blindly at the behest of an outside power. Nor do we look upon the laws Nature as enactments—a very common error. One has only to attempt to c ceive the nullification of one of these hypothetic enactments, called "Natu Laws," to find what a hopeless chaos of thought the error leads to. Action a reaction are equal and opposite. The mind is incapable of conceiving this to otherwise than it is. The creation or destruction of matter and force cannot thought. There is no gradation between something and nothing. In fine, laws of Nature are the laws of thought, and we can never transcend them. I above our mental impotence, in dealing with Nature as a machine capable being otherwise constructed, we have the crowning flower of philosophy raised the fertile fields of physiology, which discovers all the phenomenal world of ma and motion to be mere subjective states of our own consciousness. The natu itself is thus made greater than the wildest dreams of supernaturalism. It tr scends all comprehension. We must allow external existence; but it is nov wholly "transfigured realism." This matter, which we in our ignorance h contemned, is shown to be "essentially mystical and transcendental." Scie is pressing to the conclusion that all Nature has a subjective conscious side, is no longer "blind." She contains the "promise and potency" of life. F may build from this a universal soul, who "lives through all life and exte through all extent;" and believe that the laws of Nature are to us symbols of unwearying immutability which attaches to Infinite Perfection forever. Only perfection reigns re-adjustment. We may further believe, that in this wonde economy "all things work together for good;" and that the "clouds we so m dread, are big with mercy and will break with blessings on our heads." V less theology we may have a great deal more religion. We will never sus that our prayers, which enter into, and are products of the forces around have to be borne to the confines of a *boundless* shore before they are refle back in an answer.

Kansas City, Jan. 9th, 1882.

HOW MATERIAL THINGS EXIST.

BY E. R. KNOWLES.

In the latter of two essays recently published by me in this magazine cerning the nature of the existence of matter, I commended, as in part, sc and correct, the philosophy of Bishop Berkeley. But Berkeley erred in main ing that the *esse* of things is *percipi;* i. e., they can have no existence "o the minds or thinking things which perceive them." He says, (*Treatise cerning the Principles of Human Knowledge*, III.,) "That neither our thou

or passion, nor ideas formed by the imagination, exist without the mind, is hat everybody will allow." To this I assent, but not to what follows: "And seems no less evident that the various sensations or ideas imprinted on the ense, however blended or combined together (that is, whatever objects they ompose), cannot exist otherwise than in a mind perceiving them. I think an ıtuitive knowledge can be obtained of this by any one that shall attend to what meant by the term *exist*, when applied to sensible things. The table I write n, I say, exists, that is, I see and feel it; and if I were out of my study I ıould say it existed, meaning thereby, that if I was in my study I might per-eive it, or, that some other spirit actually does perceive it. There was an odor, ıat is, it was smelled; there was a sound, that is to say, it was heard; a color or gure, and it was perceived by sight or touched. This is all that I can under-and by these and the like expressions. For as to what is said of the absolute xistence of unthinking things without any relation to their being perceived, that ems perfectly unintelligible. Their *esse* is *percipi*, nor is it possible they should ıve any existence out of the minds or thinking things which perceive them."

Though our perception of real ideas or material objects is the result of the tion of the Divine Will on our minds, and the Eternal Spirit constantly sustains ıd presents these real ideas for the contemplation of created spirits, yet they ıve an existence out of the minds which perceive them. The table I write on xists, I see and feel it, and if I was out of my study, I should say it existed, ıt I mean thereby not only that "if I were in my study I might perceive it, or at some other spirit actually does peceive it," but that the table has an actual xistence *there*, in that place, whether any one is there to perceive it or not.

Both space and time, "the prime elements of the cosmos," have a real exist-ıce independently of ethereal action, and in space and time all things exist; ey (*i. e.*, space and time) are attributes of the Divine Being. We have a clear d necessary intuitive, knowledge of these because they are attributes of Him in ıom we truly live, move, and have our being, and because they are necessary our existence.

An ingenious gentleman suggests the use of burning oil for repelling hostile ets, and for harbor defense. He says: "A hundred thousand barrels of oil ured upon an out-flowing tide would cover a large area of water, and when set fire would sweep a fleet with a torrent of destruction that nothing could resist. hen a stream of burning oil ran down the Alleghany River last winter, the mes sometimes leaped up nearly 100 feet, and threw out lateral tongues of fire rible to see. Such flames around an iron-clad fleet would asphyxiate all on ard.

GEOLOGY AND MINERALOGY.

THE CHALK BEDS OF WAKEENEY, KANSAS.

BY G. C. BROADHEAD.

It was rather a bleak autumn day on the bare prairie, with the wind ho ing, rain slowly dropping and slightly freezing. Nevertheless, as dark as the looked, the white chalk beds attracted my attention. On the hill-top are fo occasional outcroppings of a pebbly conglomerate and roughly bedded rock th to forty feet thick, which has been referred to the Pliocene Tertiary. In so places this contains moss-agate : underneath this we find twenty feet of white c often used instead of lime. Stone walls are laid up with it, and houses are plastered with it, but it has only been successfully used in-doors.

Below this we find the chalk beds of the Niobrara group (cretaceous). the quarries fragments of *Haploscapha* are found, indicating a very large-s shell, sometimes measuring over two feet across.

The railroad depot and Keeny block, and some other buildings are constr ed of this white stone. It is very soft, can be easily cut with any tool, and s beds are easily frost-cracked. When first quarried the rock has a delicate d color with occasional dark specks which are probably organic. But it is s bleached.

At the "Whiting" quarry of Mr. George Pinkham may be observed a inch band of brown ochre. Mr. Pinkham grinds this in a puddling mill with wheels, in a vat eight feet in diameter by three feet high. On the hill-side spring of never-failing water from which the water is conveyed to the vat, passes into a settling vat and further on into another, carrying the ground c with it. This is dipped out, dried and sent to market, and is chiefly used glucose factory at Leavenworth City. The whiting is worth fifty to sixty c per one hundred pounds at Wakeeney.

At Leavenworth it will retail at three cents per pound. It is also use kalsomining. The business of this amounted to about ninety tons during 1 This is said to be the only whiting mill in this country. There are many c places in western Kansas where it could be made, for the supply is practicall exhaustible.

Pleasant Hill, Mo., December, 1881.

THE GENESIS AND DISTRIBUTION OF GOLD.

BY PROF. J. S. NEWBERRY.

Most of the quartz veins which carry gold belong to the class of what are called segregated veins. These occur only in metamorphic rocks, are lenticular sheets, limited in depth and lateral extension, and generally showing little of the banded structure so characteristic of fissure veins. They consist mainly of quartz, n which the gold is sometimes free, but more commonly contained in iron pyrites, with which yellow copper is often associated. Sometimes the gold is not strictly confined to the quartz veins, but extends more or less into the inclosing rocks, which are oftener than otherwise magnesian slates.

The gold in segregated veins would seem to be indigenous to the formation n which it occurs, and not, as in fissure-veins, to have been derived from some oreign source. It is usually supposed that, before they were metamorphosed, he rocks which inclose the segregated veins contained gold generally, though sparsely, disseminated through them, and that, in the process of the segregation of the siliceous matter to form sheets of quartz, the gold was somehow gathered and concentrated by it.

Sir Roderick Murchison, guided by his study of the gold deposits of the Ural Mountains, supposed that auriferous quartz veins were confined to Paleozoic ocks, but that the gold impregnation had taken place at a comparatively recent late. It was demonstrated, however, by Professor Whitney, in the prosecution of the geological survey of California, that the metamorphic slates which carry gold in the Sierra Nevada are of Triassic and Jurassic age; and in the light of ater observations, we may say that metamorphic rocks of all ages contain auriferous veins. Nearly all the great mountain chains of the world contain more or ess of such veins, and as these mountain chains have been the great condensers of moisture, and erosion has been constantly wearing down their slopes, placer leposits have been formed which have supplied most of the gold yielded by the arth to man. As it can be procured from them by the simplest methods, the work of its extraction was begun by prehistoric races, and the Altai, the Himalyas, the Ural Mountains, the Australian Alps, the Sierra Nevada, and the Rocky Mountains, have in turn contributed their millions to the treasuries of the world. These mountain chains are of very different ages, and we have abundnt evidence that gold has existed in some of them from the earliest geological mes. The oldest mountains of which we have any knowledge—the Laurentian, f Canada, now nearly removed by erosion—contained auriferous quartz veins hat have supplied gold to all the successive formations which have been derived om their ruins. The gold impregnation of the Laurentian rocks dates back ertainly to the period of their metamorphism; and this was pre-Silurian, for the ndisturbed lower Silurian strata overlap and partially cover these gold-bearing ocks.

In the same way, the gold at the Black Hills is proved to be pre-Silurian since the Potsdam sandstone which abuts against the Archean nucleus of the hill in places contains rolled fragments of the Archean rocks, and gold washed fron them in such abundance as to form rich mining ground—the so-called cemen deposits of that region. The distribution of gold from the Archean rocks ha probably been constantly going on from the Silurian age to the present day This is shown in the almost universal dissemination of gold through the drift o New England, New York, Ohio, etc., where the superficial materials have beei largely derived from the Canadian highlands. In Ohio, gold is found in th drift clays, sands, and gravels, and locally in as great quantity as in the poore placers of California. There is little doubt that the mechanical sediments derive from the wear of the Archean rocks all contain gold, and since it has been prove that gold exists in sea-water, it has probable impregnated all the organic marin sedimentary rocks as well. In the subsequent metamorphism of some of thes strata it has been concentrated in such a way as to produce auriferous quart veins rich enough to be worked.

From these facts it will be seen that there is no geological age which can b called the age of gold. It existed in the oldest rocks known, and from them an their derivatives, more modern rocks, it has been, and is now, being constantl distributed by both mechanical and chemical processes. Even some of the ign ous rocks of the western country are said to contain minute quantities of gold; and this is not surprising, if, as is supposed, much of our volcanic material is fused condition of sedimentary rocks.

GOLD IN FISSURE-VEINS.

As is well known, gold is a frequent constituent of the fissure-veins of tl Far West. The ore of the Comstock vein has yielded about forty-seven per ce of gold and fifty-three per cent of silver; and it is probable that one-half of tl so-called silver veins contain gold in sufficient quantity to be of practical valu In some true fissure-veins, gold is the only valuable ingredient, but more gene ally it is associated with several other metals. The Revenue Mine, at Tusc rora, Nev., contains silver in the form of arsenical and antimonial sulphide, ai gold in iron pyrites frequently crystalized lining cavities. At Eureka, the c occurs in chambers, which were originally filled from a solution issuing throu fissures from below and deposited as argentiferous galena and auriferous pyrit the silver and gold being in nearly equal proportions. In the great veins Bingham Cañon, and at the Cave Mine, near Frisco in Utah, the combination the same, and, as at Eureka, the sulphides have been decomposed to a spong rusty gossan. At the Bassick Mine, in Colorado, gold exists free, or in combi tion with tellurium and associated with zinc, copper and iron. In all these, a many other cases which might be cited, the gold has been brought up in a l solution impregnated with mineral matter far below, and deposited as the te

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* For example the basalt of the Snake River lava plain and according to Prof. J. J. Stevenson, the trac of Colorado.

perature and pressure were reduced. The formation of this class of auriferous deposit is well illustrated by the Steamboat Spring, in western Nevada, where hot water, flowing out through fissures produced by subterranean forces, is depositing a siliceous vein-stone, containing sulphides of iron, copper, oxide of manganese, and metallic gold. There is little doubt that, in the great mineral belt lying between the Sierra Nevada and the Rocky Mountains, where, in Tertiary times, volcanic activity was exhibited on a grand scale—sedimentary rocks upheaved and fissured in every direction, with great outflows of fused material—hot springs, like the Steamboat, were everywhere busy, doing similar work. Bursting out at different places and times, and flowing from different sources, the solutions they carried and the ores they deposited varied greatly; but the methods of accumulation, transportation, and deposition were essentially the same, namely, the leaching of various rocks by steam and hot water under great pressure, by which silica and sparsely-disseminated metals were gathered and driven toward the surface, to be deposited as the pressure and temperature were reduced. Gold collected in this manner was unquestionably taken into chemical solution, and in the resulting vein deposits we find it in strings, scales, and irregular masses, often beautifully crystallized and associated with other crystallized minerals which are certainly chemical precipitates.

We may sum up the teachings of geology in regard to the genesis and destribution of gold by saying:

First. Gold exists in the oldest known rocks, and has been thence distributed through all strata derived from them.

Second. In the metamorphosis of these derived rocks it has been concentrated into segregated quartz veins by some process not yet understood.

Third. It is a constituent of fissure-veins of all geological ages, where it has been deposited from hot chemical solutions which have leached deeply-buried rocks of various kinds, gathering from them gold with other metallic minerals.

Fourth. By the erosion of strata containing auriferous veins, segregated or fissure, gold has been accumulated by mechanical agents in placer deposits, economically the most important of all the sources of gold.—*Engineering and Mining Journal.*

MINING PRODUCT OF COLORADO FOR 1881.

Boulder	$ 535,482 38
Chaffee	100,000 00
Clear Creek	2,204,980 34
Custer	608,549 37
Dolores	125,000 00
Fremont	14,535 50
Gilpin	2,150,700 00
Grand	10,000 00

Gunnison	535,033 00
Hinsdale	187,375 00
Lake.	13,502,029 00
La Plata and San Juan	40,000 00
Ouray	78,000 00
Park	350,000 00
Pitkin	120,000 00
Rio Grande	221,000 00
Saguache	40,000 00
Summit.	1,828,000 00
Grand total	$22,680,685 09

In presenting this table of returns for 1881, it is but justice to say that while extraordinary efforts have been made to secure accurate figures, it is not claimed that they are in all cases absolutely reliable. Knowing the anxiety of the public to be advised concerning the yield of the mines for the past year, we give them as received, but it is probable that a revised table will be prepared and published. From the manner in which the returns have been received, no attempt has been made to separate the metals. Therefore it will be understood that the totals comprise gold, silver, copper and lead.

PRODUCT FROM 1859 TO 1882.

YEAR.	GOLD.	SILVER.	COPPER.	LEAD.	TOTAL.
1859 to 1870. .	$27,213,081 00	$ 330,000 00	$ 40,000 00	$	$ 27.583,081 0[illegible]
1870	2,000,000 00	650,000 00	20,000 00	. . . . . .	2,670,000 0[illegible]
1871	2,000,000 00	1,029,046 00	30,000 00	. . . . . .	3,059,046 0[illegible]
1872	1,725,000 00	2,015,000 00	45,000 00	5,000 00	3,790,000 0[illegible]
1873	1,750,000 00	2,185,000 00	65.000 00	28,000 00	4,028,000 0[illegible]
1874	2,002,487 00	3,096,023 00	90,197 00	73,676 00	5,262,383 0[illegible]
1875	2,161,475 02	3,122,912 00	90,000 00	60,000 00	5,434,387 0[illegible]
1876	2,726,315 82	3,315,592 00	70,000 00	80,000 00	6,191,907 8[illegible]
1877	3,148,707 56	3,726,379 33	93,796 64	247,400 00	7,216,283 5[illegible]
1878	3,490,384 36	6,341,807 81	89,000 00	636,924 73	10,558,116 9[illegible]
1879	3,193,500 00	15,385,000 00	*	532,362 00	19,110,862 0[illegible]
1880	3,206,500 00	18,615,000 00	*	678,800 00	23,000,000 0[illegible]
1881	. . . .	. . . .	. . . . . .	. . . . . .	22,680,685 0[illegible]
Total	$54,617,450 76	$59,811,760 14	$632,993 63	$3,341,362 72	$140,584,752 3[illegible]

* No Record of Copper.

—*Denver Tribune.*

PROCEEDINGS OF SOCIETIES.

THE ST. LOUIS ACADEMY OF SCIENCE.

The twenty-fifth annual meeting of the St. Louis Academy of Science was held in their rooms in Washington University, January 3rd. President Dr. George Engelman in the chair. In his address the President congratulated the members upon the continued success of their organization and upon their meeting again, for the first time in twelve years, in their own hall, surrounded by their own library and the germ of a museum. The Society first met in rooms in the Medical College, on Seventh and Myrtle streets. This was the place of meeting until the fire of 1869, in which a part of the college building and the museum which the Academy had collected were destroyed. By courtesy of the Board of Public Schools, rooms in the Polytechnic building were next occupied by the Society. These, however, failed to supply the wants of the Academy, and an offer of rooms from the Board of Trustees of Washington University was accepted. These rooms have been occupied ever since by the society, which meets the first and third Mondays in each month. The expense of fitting up the hall was liquidated mainly by funds subscribed especially for that purpose. The Corresponding Secretary reported an increase in the number of exchanges, so that they now amount to two hundred and sixty in foreign countries and one hundred and twenty-seven in the home list, ten of which are in the British provinces, making in all three hundred and eighty seven, an increase of fifteen over last year. Seven new corresponding members were added during the year. There were nine associate members lost to the organization by death, removal and resignation. Three members were dropped for non-payment of dues. During the year nine new members were received. The membership now numbers ninety-nine. Material for a new number of Transactions is now in the hands of the printer. So far the Treasurer, Dr. Enno Sander, has met all demands which were made upon him. He submitted the following as his report for the year: Expenses, $835; collections, $738. Balance due treasurer, $97.

The Corresponding Secretary, Judge N. Holmes, reported that the foreign exchanges were effected principally through the Smithsonian Institution, but that a few were obtained through private sources. He had received for sale and exchange eighty-one numbers of Transactions of the Academy and twenty copies of Part I of the Archæology of Missouri. He had disposed of twenty-four numbers of the Transactions and four copies of the Archæology, and exchanged fifty-six Transactions and fifteen archæological numbers, and had on hand two copies of one Transaction and one volume of archæological reports. The account showed

the total receipts and disbursements to be as follows: Receipts, $72.75; disbursements, $58.67; balance on hand, $14.08.

The President in speaking of the weather for the past year stated that the temperature had been exceedingly high, on certain days reaching 107°. The Doctor said that the reports from the Signal Service were not to be relied upon, for, although the instruments used were good, the exposure was faulty; the thermometer on sunny days going higher than it should, because of the reflection of heat from the roof over which the thermometer was placed at about the height of five feet. There were no heavy rains from the middle of June to the middle of September, but the average rain-fall was not noticeably small. The drought occurred at a time particularly unfavorable to the corn crop, and the statement of the average rain-fall during a year furnished no criterion of the crops harvested. He further stated that in all probability the balance of the present winter would be mild.

The following gentlemen were elected officers for the ensuing year: President, Dr. George Engelman; First Vice-President, Dr. Leet; Second Vice-President, M. L. Gray; Corresponding Secretary, Judge Nathaniel Holmes; Recording Secretary, Prof. Nipher; Treasurer, Dr. E. Sander; Librarian, Dr. S. Hambach; Curators, Dr. Hambach, Dr. Evers and Mr. A. Leonhardt.

Dr. Hambach was elected a life member of the Academy in consequence of his past services.

Henry Blattner was proposed by Prof. Nipher for membership. Action was deferred until next meeting.

There was received a donation from Dr. H. H. Mudd, consisting of a collection of snakes, centipedes and lizards caught in Southern Illinois.

At the Washington University, January 16th, the Academy of Science held one of its regular meetings, Dr. Engelman presiding.

The corresponding secretary was authorized to send for the Geological Repor of Colorado. A communication was also received from the Paris Zoölogical Sc ciety, asking for suggestions on the subject of the nomenclature of organic be ings, upon which there is no united systems at present. Prof. Potter, Professo of Geology, exhibited some very fine specimens of silver ore from the mines c Königsberg, silver from Lake Superior, and copper from the same lake. Th copper was particularly excellent, being almost in a virgin state. The Professc also spoke of the various places in which native lead had been found. Dr. En gelman spoke some time on the Hot Springs of Colorado. He had there, la summer, examined four hot springs. The best and longest known were those c Idaho, and Clear Springs, which are the most insignificant. Their temperature about 100°, and the prevalent ingredient, as in all the springs of Colorado, h or cold, is carbonate of soda. Some contain iron, others sulphur, others com mon salt, and some a slight admixture of purgative salts, such as sulphate

magnesia and sulphate of soda, but those which possess purgative qualities are few, and their qualities are insignificant.

At Cañon City, where the Arkansas River breaks through the famous gorge, is another spring. He would remark that those springs generally appear where the granite rocks connect with the secondary rocks of a recent date. At Cañon City the secondary rocks are lying on the same slope with the granite ones, and the same is true of Las Vegas, New Mexico and the Middle Park Springs, where the Grant River breaks through. The temperature at Cañon City is about 100°; there are here very good bathing establishments and the scenery is very beautiful.

The springs of Middle Park were to him most interesting. They are hot sulphur ones, about 112° in temperature. A good many small ones gather in a place not larger than one-fourth of the room in which they were assembled. They fall into a basin eight to ten feet high, and there is a considerable little cascade. It is roofed in with a rough sort of building and used as a mineral bath. When one first gets in he is inclined to draw his feet out, but after a while he will get under the waterfall and enjoy a fine douche. The springs are very medicinal, containing salts of soda and a small quantity of sulphur, enough to impregnate the neighborhood with an odor of hydrosulphuric acid. They are out of the way, between forty and fifty miles from the railway, reached by a tri-weekly stage communicating with the railway at Georgetown. The accommodations are not very good, but he was convinced that there was a great future for that spring from a medicinal point of view.

The next which he had visited was the Las Vegas Spring. This is situated some six miles from Las Vegas, through which town the new Atchison, Topeka & Santa Fe Railroad runs. There are good hotels and bath-houses, and the climate is such that it is expected winter guests may be invited. The waters are from 120° to 125° in temperature, too hot for use, and have to be cooled off. But the bath-houses have every accommodation—sweat baths, steam baths, etc.

A general discussion on the subject of springs was indulged in, and the grave scientists unbended themselves in jocose reflections upon the alleged healing properties of Missouri Springs, especially. Professor Potter said that chemical analysis of the Eureka Springs showed that they contained the usual ingredients of seidlitz waters, with about a fourth of a grain of mineral matter to a gallon of water, and the properties of the rest were equal to about one-fifth of those of Mississippi water.

CORAL LIFE AND GROWTH.

The Mechanics' Institute's usual winter course of free, popular lectures was begun last evening. The lecturer was Prof. Joseph LeConte, of the State University, who gave the first of a series of three lectures, in which he will expound the mysteries and beauties of coral life and growth. He spoke for an hour and a half last evening, greatly to the entertainment of his audience, illustrating his

subject with numerous drawings, which materially aided comprehension. He said that he had selected the subject because of its great popular and scientific interest, and because he had personally investigated it, having spent a whole winter in Florida and the adjacent keys for that purpose. The matter was of great interest because of the strange forms and gorgeous coloring of the animals by which these reefs were made; on account of the gem-like beauty of the islands formed by their agency; on account of the large quantity of land which had been added to the habitable globe, wholly through the influence of the coral animals, now inhabited by hundreds and thousands of people, and which would not exist but for these creatures; because of the fact that the largest body of land which has been added to the habitable globe had been in the territory of the United States—the peninsula and keys of Florida, and, finally, on account of the dangers to navigation arising from coral reefs.

THE FLORIDA REEFS.

Coral reefs are peculiarly dangerous to navigation because of their rising abruptly, so that though the sounding line may show 6,000 feet of water within half a mile, the reef may rear its perpendicular wall for the ship's destruction. The most dangerous point for navigation upon the face of the earth is the reefs of Florida. There are more wrecks upon that coast than in any other portion of the world. The largest town in Florida, Key West, is built upon a coral reef, on account of the frequency of wrecks upon the coast. If it were not for the wrecking business the town would not exist. With the exception of cocoa-nuts there is absolutely nothing raised upon the reef. The wreckers came first to prey upon the wrecks, then came merchants to prey upon the wreckers, next lawyers and doctors to prey upon both classes, and finally the clergymen to pray for all. [Laughter.] The subject of corals was, also, the Professor said, of scientific interest, because in these coral reefs we had the proofs of the vast oscillations and variations in the earth's crust, on a scale of which we have no other evidences at all.

A very wide spread misunderstanding exists as to the manner in which reefs are formed, one which has entered into the public mind, and of which it is almost impossible to dispossess the public mind. The idea is that these animals are little insects; that they build like ants and bees do, and when they are alarmed they disappear into their little burrows, and these reefs are accumulations of millions of these little insects in generation after generation. I shall show that there is not the semblance of truth in this idea.

The Professor then explained that the coral animal is a polyp belonging to the group of radiata; that it consists of limestone deposits in the shape of a hollow cylinder with top and bottom disks, surmounted with tentacles, containing a stomach and enveloped with gelatinous organic matter. The tentacles or arms are provided each with a mouth for the absorption of food. The coral is coralline limestone after the gelatinous organic envelope is decayed and removed. The animals which build reefs are not much larger than pin-heads. The development

and growth of the coral tree and head coral was clearly explained, showing it to be analagous to the same process in vegetation. It was further explained that coral formed and threw off eggs, which floated to some suitable place, and there began the process of development independently, forming new colonies, which in time connect and form reefs, upon which are deposited accretions, in time building up keys and islands.

Reef-building corals will not grow at a depth of over one hundred to one hundred and twenty feet. There have been reef-building corals found at a depth of 1,000 feet, but they were dead—drowned by being carried below their depth. This confines them to coast lines and submarine banks. Coral will not grow where the temperature is lower than 68° at any time, that is of the ocean, not the air. Therefore, they are confined to the tropical regions. They will not grow except in clear salt water; hence there is always a break in reefs opposite the mouth of a river. Finally, they demand free exposure to the beating of the waves. The more violently the waves beat the more rapidly the corals grow, because the agitation gives them ventilation. Corals will grow in the face of waves whose beatings would gradually wear away a wall of granite. The four kinds of coral reefs found in the Pacific Ocean are fringe reefs, barrier reefs, circular reefs, inclosing lagoons in the ocean, and small lagoonless coral islands. The explanation of the formation of the last three named will form the subject of the next lecture.—*San Francisco Chronicle.*

CANADIAN ACADEMY OF ART.

A meeting was held at Montreal, Canada, to create a Canadian Academy of Art, Dr. J. W. Dawson, C. M. G. (Chairman), and Dr. T. Sterry Hunt, Montreal; Dr. Daniel Wilson, President of the University of Toronto; Dr. Selwyn, of the Geological Survey; Dr. Lawson, of Dalhousie College, Halifax; Mr. J. M. Lemoine, President of the Literary and Historical Society of Quebec, and Mr. Fauchar de St. Maurice, M. P., were present at the meeting. The proposed Academy is to be composed of six sections representing English letters, French letters, history and archæology, mathematical and physical sciences, geological sciences and biological sciences. It is probable that the membership will be limited to ten or twelve in each section.

HISTORY.

WHO DESTROYED THE ALEXANDRIAN LIBRARY?

BY WM. EMMETTE COLEMAN.

The famed Alexandrian Library, said to have contained several hundred thousand volumes, was originally contained in the Alexandrian Museum, situated in the Bruchion, the aristocratic quarter of the city. In the course of time an additional library was established in the adjacent quarter, Rhacotis, and placed in the Serapion, or Temple of Serapis. This library was called the Daughter of the one in the Museum, and is said to have eventually been composed of 300,000 volumes, while the Bruchion Library contained 400,000. In my judgment these figures are exaggerations. When the fleet was set on fire, by order of Julius Cæsar, during the siege of Alexandria, B. C. 47, the wind carried the flames to the locality of the Bruchion and destroyed the library; 400,000 volúmes perishing, according to the statement of Orosius (quoted by Bonamy, *Dissertation historique sur la Bibliothique d' Alexandrie, in Histoire de l' Academie des Inscriptions et Belles Lettres*, Vol. IX 17 '36). The Serapion, however, escaped, and was further enriched not long after by the present of 200,000 volumes to Cleopatra by Mark Antony.

In A. D. 390, Theophilus was the Christian Bishop of Alexandria. A disturbance arose between the pagans and Christians of that city. The Serapion was the headquarters of the pagans. Theophilus, who is described as "a bold, bad man, whose hands were alternately polluted with gold and with blood," obtained a rescript from the Emperor Theodosius, enjoining the destruction of the Serapion. Theophilus drove out the *Savans* who assembled in the Serapion, dispersed the library, overthrew the temple, and built a church on its ruins. A few years after this Paulus Orosius, a Spanish disciple of St. Jerome, tells us that on his return from Palestine, he saw at Alexandria the empty book-cases which had been in the Serapion previous to its pillage by Theodosius. (Bk. vi, ch. 15.) It is clear, then, that at the beginning of the fourth century, the celebrated Alexandrian Libraries had both ceased to exist: nevertheless many believe that the great Library of the Ptolemies was burned by the Arabs in the seventh century.

The principal foundation for this story is a passage in the writings of Abulfaraj (Latin, Abulfaragius), an Armenian Christian author of the thirteenth century. He is also called Gregorius Bar Hebræus, that is, Gregory the son of a Hebrew, for he was a Jew by birth. In 1264 he was elected primate (a position next to patriarch) of the eastern Christians. He wrote a *Chronicle* in Syriac, of universal history from Adam to his own time. He abridged this work in Arabic,

under the name of *History of the Dynasties*, an edition of which in Arabic and Latin was published at Oxford in 1663, edited by Pococke, in two quarto volumes. It is in this abridgment we find the mention of the burning of the Alexandrian Library by the Arabs. Amru, the Arabian conqueror, after a siege of fourteen months, succeeded in capturing Alexandria, A. D. 640. Omar was then the Mohammedan Khalif (or Caliph), Amru being his principal general. The following is a literal translation of the passage in Abulfaragius relative to the destruction of the Library: "John the Grammarian came to Amru, who was in possession of Alexandria, and begged that he might be allowed to appropriate a part of the booty. 'Which part do you wish for?' asked Amru. John replied, 'The books of philosophy which are in the treasury (library) of kings.' Amru answered that he could not dispose of these without the permission of the Emir Al-Moumenin Omar. He wrote to the Emir, who replied in these terms, 'As to the books you speak of, if their contents are in conformity with the Book of God [the Quran] we have no need of them; if, on the contrary, their contents are opposed to it, it is still less desirable to preserve them, so I desire that they may be destroyed.' Amru-Ben-Alas, in consequence ordered them to be distributed in the various baths in Alexandria, to be burned in the stoves, and after six months not a vestige of them remained." (See *History of the Dynasties*, Book ix, page 114, Oxford, 1663.)

There are various excellent reasons for doubting the truth of this story. First, the silence of earlier writers. Eutychius, patriarch of Alexandria in the tenth century, in his *Annales of Alexandria*, tom. ii, pp. 316–319, has given a detailed narrative of the capture of Alexandria by Amru, but not a word about the burning of the library. Eutychius, who lived in Alexandria two hundred years after its capture, never heard of the burning, while Abulfaragius, who lived in Asia, six hundred years after, can give full details, even the very words of the Khalif Omar! Elmacin, who wrote a *History of the Saracens* early in the twelfth century, and a Christian writer, also narrates the capture of Alexandria, but says nothing of the destruction of the library. (*Historia Saracenica Georgii Elmacini*, 4to, 1625, page 28). Murtadi, of Cairo, wrote in Arabic, in the thirteenth century, a work on the "Wonders, etc. of Egypt," (French translation, Paris, 1666,) in which an account of the conquest of Egypt by Amru with Omar is given, including the correspondence of Amru with Omar, but no mention is made of the library-burning story. The best of all the Arabian chroniclers was Abulfeda of the fourteenth century, who in his *Annales Moslemici ad Annæ Hegiræ CCCVI*, published at Leipsic in 1754, gives full details of Omar's conquests, but omits all reference to the library-burning; neither does he refer to it in his valuable work on the *Geography* of Egypt. A few Mohammedan writers have repeated Abulfaragius' story, as Mahirzi, Ibn Chaledun, Hadschi Chalfa, etc., but their testimony, being borrowed from Abulfaragius' work, has no weight. There seems, however, to have been one Arabian writer who referred to this event before Abulfaragius, and that is Abd-Ul-Latif (Abdollatiph), who wrote a valuable work on the history, antiquities, and geography of Egypt a short time before

Abulfaragius was born (*Compendium memorabilium Ægypti*, Tubingen, 1789). It is probable Abulfaragius was indebted to Abdollatiph for his first information concerning this story. Neither gives any authority for his statements. So much for the external evidence.

The internal evidence is strong against the story. John, the Grammarian, who is said to have requested the books from Amru, was the last disciple of the Neo-Platonic Ammonius Saccas, and was surnamed *Philoponus* (lover of labor) on account of his laborious studies of grammar and philosophy. Some of his treatises are still extant, one being in Fabricius' *Bibliotheca Græca*, ix, pp. 458–468 (See Gibbon's Decline and Fall, Vol. 5, p. 228). Now, John *was dead* before Alexandria was captured, December 21–22, 640. (See Delepierre's *Historical Difficulties*, London, 1868, page 36). The foundation of the story, John's request, is therefore false.

Second. In a letter from Amru to Omar (Etuychius *Annales* ii, 319), Alexandria is described as containing 4000 baths. The volumes were doubtless mostly parchment (what an absurd idea to heat baths with parchment!), and to keep 4000 baths heated six months, what an enormous quantity of MSS would be required. The Alexandrian baths were constructed on the *Hypocaust* principle, we are told, that is, the fires were kept burning in a vaulted chamber below, from which by tubes the upper rooms were heated; and to keep one such heated would require over one hundred MSS per day; more likely several hundred. But taking one hundred per day for 4000 baths, in one day 400,000 volumes would be consumed, and in six months nearly seventy-five millions would be required. Supposing the library contained 700,000 volumes, then for 4000 baths to consume them in six months would be an average of *less than one* MS a day for each bath. This part of the story is a palpable falsehood.

Third. The destruction of the religious books of the Jews and Christians was opposed to the orthodox precepts of the Mohammedans. The Khalifs forbade, under heavy penalties, the destruction of all such works, and we have no record of any such acts of vandalism in the early conquests of the Saracens, and it was decreed that the works of profane science, historians or poets, physicians or philosophers, might be lawfully applied to the use of the faithful. See Reland, *de Jure Militari Mohammedanorum*, in his third volume of *Dissertation*, p. 37, quoted in *Gibbon*, v. 230.)

None of the Greek writers, who were bitterly hostile to the Saracens, allude to their burning of the Library. Even Abulfaragius in the original Syriac version of his *Chronicle* did not refer to the burning; it was only when he came to prepare his abridgment in Arabic, in his old age, that he added this narrative.

Among the first to dispute the truth of Abulfaragius' story was Reinaudot in his *Histoire des Patriarches d' Alexandrie*, page 170. Succeeding him, Gibbon advanced cogent reasons for a rational skepticism as to its truth. (*Decline and Fall*, chapter 51, Vol. 5, pp. 228–231, Harper's Ed). Since Gibbon, Reinhard (in a special dissertation published at Göttingen in 1792), Assemanni, and many others have declared against its truth. Octave Delepierre, Secretary of Legation

to the King of the Belgians, in his valuable *Historical Difficulties and Contested Events*, London, 1868, has discussed the question and decided against its truth. An excellent summary of the evidence against its truth, based principally on Gibbon, is found in the London *Human Nature*, Vol. 1, pp. 546–7. On the other side, among the advocates for the truth of the Saracenic burning are found De Sacy, Langles, Von Hammer, M. St. Martin, Prof. White, and lastly M. Matter. In the *Histoire de l' Ecole d' Alexandrie*, by M. Matter, Paris, 1840, is contained all the authorities for and against the burning of the Library by the Arabs.

The *Encyclopædia Britannica* (8th edition, Vol. 2, p. 733,) speaks of the burning of the Library as an act of barbarism "repugnant to the character of Omar and his general," and continues: "It is highly probable that few of the 700,000 volumes collected by the Ptolemies remained at the time of the Arab conquest, when we consider the various calamities of Alexandria from the time of Cæsar to those of Caracalla, Diocletian and the disgraceful pillage of the Library in A. D. 389, under the rule of a Christian Bishop, Theophilus, a far less respectable character than the Arabian conquerers."

Very few scholars of to-day credit the story of the Saracenic destruction of the Library, the "consensus of the competent" being that it is simply an Oriental fiction of the Middle Ages; and such is the opinion of the present writer.

PRESIDIO of San Francisco, California.

MISSOURI HISTORICAL NOTES.

COMPILED BY G. C. BROADHEAD.

1762—The country west of the Mississippi River ceded to Spain by France, but not made public until 1764.

1800, Oct. 1—Louisiana, including all territory west of the Mississippi River, ceded by Spain to France under the treaty of St. Ildefonzo.

1804—Louisiana purchased from France by the United States and divided into two territories, Orleans and Louisiana—the latter included Arkansas, Missouri and all the territory west. Capt. Amos Stoddard was temporary governor.

Don Charles Dehault Delassus was the last Spanish governor. The country for a short time was attached to the government of the territory of Indiana. Gen. W. H. Harrison, Governor; capital, Vincennes.

1805—Territory of Louisiana organized; Gen. James Wilkinson, Governor; Frederick Bates, Secretary. The territory was divided into five districts, afterward called counties, and named respectively St. Louis, St. Charles, St. Genevieve, Cape Girardeau and New Madrid, the latter including Little Prairie and Arkansas. These counties extended indefinitely westward, St. Louis being bounded on the north by the Missouri River and St. Charles, including all north of the river to the Rocky Mountains.

1807—Meriwether Lewis Governor of Upper Louisiana.

1808—District of Arkansas organized.

1809—Death of Lewis; Frederick Bates Secretary and acting Governor.

1810—Benjamin Howard, Governor of Upper Louisiana.

1812—Frederick Bates Secretary and acting Governor.

1812, Dec. 7—Territory of Missouri organized, including the districts or counties of St. Charles, St. Louis, St. Genevieve, Cape Girardeau, New Madrid and Arkansas, the latter still attached to New Madrid county.

1808 Nov. 10—Grand council with Indians at Ft. Clarke (Ft. Osage, afterward called Sibley) by which the Osages relinquished title to all territory east of a south line from Ft. Clarke to the Arkansas River.

1813—First territorial legislature, Wm. Clarke, Governor.

1818—County of Washington organized.

1814—County of Lawrence (in Arkansas) organized, from western part of New Madrid.

1816—County of Howard organized, including all west of a line due north of the mouth of Osage River; also all that portion between the Osage and Missouri.

1818—County of Cooper organized, including all of Howard south of Missouri River.

1815—Gabriel Rupe settled near Lexington.

1818—Counties of Jefferson, Franklin, Wayne, Lincoln, Madison, Pike and Cooper organized.

1819—Territory of Arkansas organized.

1815—Indiana relinquished title to territory north of Missouri Rivery.

1820—Lillard county organized from Cooper, with Mt. Vernon as county seat. This place is about where Berlin on the Missouri River is.

1821, March 2—Missouri admitted into the Union.

1820—Jackson County taken off Lillard, and included what is now Cass and Bates.

1834—Name of Lillard changed to Layfayette.

1834—Johnson County taken off Lafayette.

1835—Van Buren County taken off Jackson, included the present county of Cass and as far south as line between townships 39 and 40.

1849—Name of Van Buren County changed to Cass.

1833—Bates County was established, but not organized until 1841.

1854—Bates County reduced to its present limits. The line of Cass and Bates is now Grand River and on line between townships 42 and 43.

1837—That portion known as Platte Purchase added to Missouri, included all west of a line due north of mouth of Kansas River.

Signor C. Desimoni, of Genoa, has just published a monograph upon John Cabot (father of Sebastian Cabot), the discoverer of Labrador and Cape Breton Island prior to Columbus. He examines carefully all the authorities relating to

the subject, and prints for the first time in one collection all the known official documents, notices in accounts, passages in contemporary chronicles, or correspondence in any way bearing upon John Cabot and his discoveries. Some of these, drawn from Spanish and English sources, are new. The author adduces the conclusions of Mr. Henry Harris, an American in Paris, who is at work upon a new publication on Columbus, to support his own that the Continent of America was discovered by Cabot in 1497, at least a year before Columbus found *terra firma.*

ASTRONOMY.

SOME PHYSICAL CHANGES ON THE SURFACE OF JUPITER.

BY PROF. C. W. PRITCHETT, MORRISON OBSERVATORY.

The changes which have taken place, within the last three years, on the apparent surface of the planet Jupiter, are really wonderful. To one who has seen the giant planet but a few times in his life, and even to an astronomer, who has not noted from week to week the markings on his surface, a detailed account of their changes would be almost incredible. Perhaps the phenomenon of the great red spot, which became so conspicuous in July, 1878, and which still persistently holds its place, has awakened an unusual interest in the study of his surface, but certain it is, that never before, has his disc been so closely watched, and never have so many phenomena been noted, in so short a time, as within the last three and a half years.

In this note my object is not to describe these changes, but specially to mention an instance observed here on the night of December 23rd. It chanced to be one of the finest nights of the whole year. The surface of the great planet was rarely ever seen under better conditions of altitude and atmosphere. Every line and marking came out with a distinctness which was a wonder even to an experienced observer. The great red spot, by the Jovian rotation, was approaching the central meridian of the disc; and I had begun my usual observation of the transit of the preceding end, when my attention was called to a condensed white nucleus situated in the north margin of the most southern of the equatorial belts. The threads of the Filar Micrometer, had been adjusted to the rotation axis of the planet, by the ephemeris of Mr. A. Marth. (Month. Not. R. A. S , Vol. 41, No. 7). One fixed thread was placed on one extremity of major axis of spot, and the movable thread was placed on the other extremity of that axis, and these threads were kept to this position by the driving clock, and an adjusting screw. At 7h. 7m. of local mean time the following end of red spot and the bright nucleus were on the same thread, or the bright spot was on the same

Jovian meridian directly north of the following end of red spot. As it requires more than one hour for the Jovian rotation to carry the major axis of spot across the central meridian, and all changes of relative position must take place between my micrometer threads, I had a very rare opportunity to compare changes, however slight. Not twenty minutes had passed till I could see, independently of the threads, that the white spot had a rapid motion relatively to the red spot. It was so marked and proceeded so uniformly with the time that I resolved to measure it minutely. My observation of the transit closed at 8h. 10m. and then I estimated by the eye that the bright nucleus had gained on the following end of the red spot, in one hour, three-eighths of the interval between my threads. The mean of a number of careful measures proved it to be three hundred and sixty-one one-thousandths of the interval, or 4.33″ of the Jovian disc.

Now the question comes up, was this a motion of translation? If so, we shall have to believe that a motion can take place in the Jovian atmosphere at the rate of nearly seven thousand miles per hour. As this seems scarcely credible, I prefer to think that this angular displacement is the index of a progressing transmission of light through a lower stratum of atmosphere, or else a part of an auroral display. I am the more inclined to consider the phenomenon as the result of a progressive transmission of light from the body of the planet through changing media, since the size and consistency of the nucleus changed considerably during the hour. I decline, however, to speculate on the subject, and give the fact and measure for what it may be worth.

Within the last few years many of these bright spots have been observed. That they seem to have a rapid motion has been shown over and over again. Some of them have been followed entirely around the planet.

I will add, that for the last two years the color of the equatorial belts has remained gray or brown; for some time previously they had borne a ruddy hue. Occasionally the margins of the main belts have been tinged with red, and sometimes with a very fine blue. Within the last two years two very marked changes have occurred: 1. There are now three distinct broad equatorial belts in place of two. 2. A very conspicuous belt now stretches entirely across the Southern Hemisphere of the planet, and in apparent contact with the red spot. Its northern margin, on the finest nights, is almost blue. It has been forming for months past, but has taken its distinct outline within the last six months. It is now a prominent feature of the great disc immediately south of red spot. It would be highly instructive could all these successive changes be presented to the eye by such drawings as would show not only the correct shape and outline through successive weeks, but also discharges in consistency, continuity and color.

MORRISON OBSERVATORY, January 6, 1882.

NOTE.—On January 22d at 7h. 30m., an entirely new belt was observed in the Equatorial Zone of Jupiter, situated between the middle and southern equatorial belts. It was continuous and very fine and sharp. I have never before seen a belt in this position, though I have carefully examined the planet many

hundreds of times within the last few years. The space between the broad equatorial belts is usually more or less filled with irregular cloud masses. On this occasion it was entirely free from them. The middle and northern equatorial belts were very fine and even, and assumed their usual ruddy hue, while the southern equatorial belt was nearly three times broader than the other two and was quite dark. The atmosphere was the finest I ever had for distinct and steady images.

GLASGOW, MO., January 23, 1882.

ASTRONOMICAL NOTES FOR FEBRUARY, 1882.

BY W. W. ALEXANDER, KANSAS CITY, MO.

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Transit.
1st.	22h. 08m.	12° 02′	1h. 21m. P. M.
5th.	22 27	9 19	1 23
10th.	22 40	6 35	1 17
15th.	22 38	5 22	0 53
20th.	22 23	6 04	0 21
25th.	22 00	8 05	11 35 A. M.
28th.	21 52	9 51	11 14

VENUS.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Transit.
1st.	20h. 48m.	18° 57′	11h. 57m. A. M.
5th.	21 03	17 58	0 00
10th.	21 28	16 12	0 06 P. M.
15th.	21 53	14 14	0 11
20th.	22 18	12 05	0 15
25th.	22 41	9 49	0 19
28th.	22 55	8 24	0 21

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	5h. 46m.	26° 53′	8h. 57m. P. M.
5th.	5 47	26 49	8 42
10th.	5 48	26 43	8 24
15th.	5 51	26 38	8 07
20th.	5 54	26 32	7 52
25th.	5 59	26 26	7 36
28th.	6 03	26 22	7 28

Semi-diameter on the 1st, 6.3″; on the 28th, 5″.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit
1st.	2h. 59m.	16° 05′	6h. 11m. P. M.
10th.	3 02	16 21	5 39
20th.	3 07	16 42	5 04
28th.	3 11	17 01	4 37

Semi-diameter on the 1st, 19.4″; on the 28th, 17.8″.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage
1st.	2h. 19m.	11° 23′	5h. 30m. P. M.
10th.	2 20	11 35	4 56
20th.	2 23	11 51	4 20
28th.	2 25	12 05	3 51

Semi-diameter on the 1st, 8,4″; on the 28th, 8.0″.

APPARENT ELEMENTS OF THE RING.

Outer Major Axis 39.9″, Minor Axis 12.7″. Inclination of northern semi minor axis to circle of declination from North to East, 10.7′. Elevation of th Earth above the plane of the ring, 18° 35′; elevation of the Sun 20° 24′. Earth' longitude from Saturn, counted on plane of ring from the ring's ascending nod on equator, 88° 34′, ecliptic 45° 50′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transi
1st.	11h. 16m.	5° 33′	2h. 27m. A. M.
14th.	11 14	5 44	1 34
28th.	11 18	5 58	0 37

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transi
1st.	2h. 48m.	14° 17′	5h. 49m. P. M.
14th.	2 48	14 20	5 08
28th.	2 48	14 25	4 14

PHENOMENA.

On the 2d—Mars, stationary in right ascension.

On the 2d—Neptune in quadrature, or 90° east of the Sun.

On the 3d at 10h. P. M., Mercury in ascending node.

On the 5th at 11h. P. M., Jupiter in quadrature.

On the 5th at 11h. 55m. P. M., conjunction of Uranus and the Moo Uranus north 6° 10′.

On the 6th at 5h. P. M., Venus in aphelion.

On the 6th at 9h. P. M., Mercury, greatest elongation east 18° 13′.

On the 8th, Mercury in perihelion.

On the 13th at 6h. A. M., Mercury stationary in right ascension.

On the 17th at 11h. 22m. P. M., conjunction of Venus and the Moon. Venus south 6° 47′.

On the 18th at 9h. A. M., conjunction of Mercury and the Moon. Mercury south 1° 38′.

On the 18th at 9h P. M., Mercury at greatest heliocentric latitude, north.

On the 20th at 6h. P. M., conjunction of Venus and the Sun, superior.

On the 22d at 2h. P. M., conjunction of Saturn and the Moon. Saturn south 4° 38′.

On the 22d at 12h. P. M., conjunction of Neptune and the Moon. Neptune south 3° 34′.

On the 23d at 9h. A. M., conjunction of Jupiter and the Moon. Jupiter south 2° 07′.

On the 26th at 1h P. M., conjunction of Mars and the Moon. Mars north 5° 11′.

METEOROLOGY.

CONTINUOUS IMAGES OF LIGHTNING.

BY R. A. BLAIR.

The evening of June 18, 1875, in the locality of Sedalia, Mo., was remarkable for its unusual electrical display. The north was sullen and black. An almost continuous occurrence of sheet-lightning in the background illuminated the dense clouds in front, through which intense strokes of zigzag lightning made a terrific effect. Following one of these last forms, my attention was arrested by its leaving a counterpart or image of itself, which was brought into distinct and sharper relief by the flashes of sheet-lightning occurring as above stated.

The image disappeared from below upward, gradually; its entire duration being about forty or forty-five seconds. Fifteen minutes afterward a similar stroke left an image equally as sharp, with a duration of, say, fifteen seconds. Both images appeared of a sharp brown color.

Will some one explain the phenomenon?

NOTE.—Were it not for the duration of these images we should be inclined to attribute to their presence to the impression of the vivid flash upon the retina of the observer. The dark color of the images also confirms this idea, but such images usually last much less time, so that if Mr. B. is positive as to the time, we must look to some peculiar condition of the atmosphere for the explanation of the phenomenon.—[ED. REVIEW.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

Highest barometer during month 29.35, on the 16th. Lowest barometer during month 28.54, on the 27th.

Highest temperature during month 30°, on the 13th. Lowest temperature during month 5°, on the 17th.

Highest velocity of wind during month 46, on the 1st. Prevailing direction south. Total travel, 10,782 miles.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Dec. 20th to Jan. 1st.	Jan. 1st to 10th.	Jan. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	23.5	18.7	11.4	17.9
Max	46.5	42.5	36.9	41.5
Min. and Max	35.1	30.6	24.0	29.9
Range	23.0	24.8	25.5	24.4
TRI-DAILY OBSERVATIONS.				
7 a. m.	31.0	28.4	22.2	27.2
2 p. m.	39.8	38.4	33.4	37.2
9 p. m.	33.0	32.3	25.5	26.9
Mean	33.4	32.9	26.6	31.0
RELATIVE HUMIDITY.				
7. a. m.	.84	.77	.80	.80
2 p. m.	.70	.73	.87	.77
9 p. m.	.80	.78	.82	.80
Mean	.78	.76	.83	.79
PRESSURE AS OBSERVED.				
7 a. m.	28.90	28.96	29.00	28.95
2 p. m.	28.91	28.93	28.96	28.93
9 p. m.	28.97	28.97	28.97	28.97
Mean	28.93	28.95	28.97	28.95
MILES PER HOUR OF WIND.				
7 a. m.	10.6	9.8	13.6	11.3
2 p. m.	20.0	14.3	18.8	17.7
9 p. m.	11.8	10.3	14.2	12.1
Total miles	3852	3212	3718	10782
CLOUDING BY TENTHS.				
7 a. m.	4.4	6.8	4.5	5.2
2 p. m.	5.8	7.8	4.8	6.1
9 p. m.	4.6	6.9	2.2	4.4
RAIN.				
Inches	——	.21	.32	.53

METEOROLOGICAL NOTES.

ISAAC P. NOYES.

The above title is given to this article for the reason that herein I propose to speak of a number of points on the subject instead of devoting the whole article to one department, or to writing at this time generally upon the subject of the weather.

The Dark Day.—A peculiar condition of the atmosphere occurred September 6th, 1881, in many parts of the eastern section of the United States, which has passed into history as the "dark day."

The writer was on the Atlantic sea-board in the southern part of Rhode Island. Here it was quite foggy and the signal-horn at the light-house, at Point Judith, was sounded at stated intervals to warn mariners as to the location of that prominent and dangerous point of land making into the sea. But there was nothing peculiar about this, even though the sun was obscured, for it is a common thing to have such a fog here. Later in the day there appeared a yellowish tint in the atmosphere. There was a fine gentle breeze from the southwest and no sign of any sudden atmospheric change, though the air was quite "close." The while it grew darker and darker. We thought it local; but the reports from other places that evening showed that it was quite universal throughout the northeast section of the United States. What could be the cause of such a phenomenon? My friends, knowing that I had paid some attention to meteorology appealed to me. My reply to them was, I cannot solve it further than from the cloudiness and "closeness" of the atmosphere we must be in the confines of low barometer, and from the direction of the wind "low" must be traveling to the north of us.

But almost everybody said they smelled smoke, while a few opposed this idea for the reason, they said, smoke is heavier than air and travels near the ground, while this seems as high as the atmosphere itself. Some thought that there must be a hurricane to the westward and that in time it would reach us. My friend was building a small summer-cottage; it was all ready to raise, but the carpenters refused to take the risk—"If that blizzard reaches here it will destroy all our work; we had better quit for the day." It was then three o'clock in the afternoon. The cattle came up to the house as on regular occasions for the night, and the fowls went to roost.

Many people were scared and thought the world had come to an end. The stores and workshops were regularly lighted as at night. Everything green had a beautiful bluish tint—a tint that we would liked to have "fixed" if possible. About ten o'clock at night when there was no fire about the house or any near us we went out to take another survey. All was quiet—the larger stars were faintly visible. My friend and I agreed that there was smoke in the air, and that even the fires of all the farm-houses around there could not produce such an

effect—and the fires were not only all out now but had been out for a number of hours. We agreed that there must be a "big fire" somewhere, but we little dreamed that that fire was in Michigan, and that our fellow citizens out there were at that very moment in such a strait.

When the weather-map for the 6th of September came it revealed "Low" very high in the northeast. Therefore, the cloudiness and "closeness" in this section. We were in the confines of "Low"—it was too far away from us to produce rain—we were on the outskirts and got the attending cloudiness. "Low" being on such a high line made it very warm. Now we could understand why, although we smelled smoke, it was not *near the ground.* It was produced by an immense fire and that fire was at a great distance, hence the reason why it so diffused itself in the air and why it was not more noticeable along the ground than through the atmosphere generally. By this it will be seen that all though this phenomenon affected the air, it had nothing to do with meteorology; it was quite distinct from it and was the result of other natural causes rather than coming under the workings of "Low." Sure "Low" made the general cloudiness but it did not produce the yellowish tint in the atmosphere nor bring on the premature darkness of the day.

Fogs.—Some months ago, in connection with the weather, I conceived the idea of studying fogs. This summer while on a trip from Washington to Rhode Island, via Long Island Sound, I fell in with Captain O. C. Griffin, captain o "the sound" steamer "Stonington." I mentioned the subject to him. I proposed to send him a package of postal cards addressed to me, and asked him to send me a daily report of the weather of the "Sound," and particularly as to the degree and nature of the fog at night. He cheerfully agreed to comply with my wishes in this respect and faithfully forwarded the cards with the report to me every day. After receiving these cards for about a month I spread the maps on the floor, in a line according to date and arranged the cards in a like manner beside them. I think that any lover of science would have been delighted to se how nicely the two fitted and agreed with each other and how perfectly the on proved the other.

Here is a daily map of the atmosphere, made in Washington. Captain Gri fin of course could have had no influence over the map, nor could he have know what it would be from day to day; neither could the parties here who make tl map know anything of the report of Captain Griffin. Yet, when the two came be compared, they fitted into each other as nicely as the work from different m chanics made after the architect's complete drawings.

From these reports there seems to be two kinds of fog, *i. e.*, fogs from tv different conditions. First, a general fog which is the result of low barometer ar which follows or exists within the area of "Low." A fog of this class will co tinue through the day as well as at night, so long as the locality is within the ar of low barometer. It will not, however, be so thick during the day as at nigh and then much depends upon the force of the wind to remove it to other plac say in the form of clouds. Fogs of this nature, by sailors are called "sea fogs

yet the sea is not responsible for them only so far as it furnishes plenty of material; it does not furnish the active agent (heat) which creates them, and they may occur inland or on the sea-board or lake shore wherever there is sufficient moisture to develop them.

Fogs of the other type, which sailors call "land fogs" may exist even in the very centre of the area of high barometer, and separately or in conjunction with it. The peculiarity of it is that it may not, and generally does not, reveal itself in force until about sunrise. The land retains the heat far better than water, and the land, especially in the neighborhood of bodies of water, retains much moisture.

All night long the land has been giving off its heat, taking more or less moisture with it. If through the night there is a good breeze this cloud like moisture will be wafted away toward the nearest or most powerful centre of "Low" and there will be no local fog; if on the contrary it is a still night this moisture will hover over the place, the while growing thicker and thicker. About sunrise the land has lost its most heat. So long as there was heat to ascend it buoyed up the suspended moisture, in this case called "fog" and kept it well expanded. The land becoming quite cool, the specific gravity of this suspended moisture, in the absence of ascending heat, settles together and returns to the ground in masses, the while becoming more and more dense forming a thick, heavy fog, probably the most impenetrable of all fogs. The returning sun, however, soon dispels this fog—evaporating it or forcing it away by establishing a centre of concentrated heat or local "low"—generating a breeze which transports it elsewhere in the form of clouds. From our present light upon the science of meteorology such would seem to be the nature and cause of fogs.

Where our Storms come from.—One of the strangest phenomena presented to us is the indifference of the most intelligent portion of the world to the actual facts of the weather and the eagerness with which they will jump at the mere *ipse dixit* of some person who trusts more to his imagination than to the plain simple facts in the case. Some "great European scientist," or some "great weather-wise American" has something to say about the weather; no matter how absurd, it is passed around from city to city. The people, who don't know anything about it, read and wonder, but are unable to do otherwise than to accept it, same as the world centuries ago, with no knowledge of the geography of the globe, necessarily accepted the last new tale of every adventuresome navigator or explorer.

Within the past year a "great English scientist" advanced some ideas, not very new however, about electric currents being the cause of the changes in our weather. "Electricity" has to shoulder a great deal; when one cannot explain a phenomenon in nature he puts on a wise look and credits it to electricity. The greater the reputation of the man the more ready the world is to accord him great wisdom and to accept whatever he says without question.

In regard to any "great English scientist," England, and indeed the whole British Isles, are not one-hundredth part large enough to study meteorology on—might as well undertake to study the geology of the world on an ordinary house

lot. Meteorology wants an extensive territory. In Europe and Asia they have the territory, but their countries being independent of each other and there being no united action between them, with the exception of Russia, they are all too small to study meteorology in. In Europe and Asia they can never make a success of this study until they establish their stations without regard to country lines and send their daily reports into some common centre, or they might make a compromise in this and send the reports in to some three or four centres.

In order to establish where storms come from, at least how they pass over the country, we want stations over an extended territory—the greater the extent of the territory and the greater the number of stations the better, at least we want a sufficient number of stations to make the work reliable.

There is a common idea that all our storms come from the tropics. About the middle of November a short article appeared in the New York *Sun* to this effect; it was extensively copied by the papers throughout the country and was given a free and wide advertisement.

Now, I have claimed in all these papers that there is no way of studying the weather but by the weather-map. The Weather-Map of the United States is the most complete thing in this line the world has ever seen, for the simple reason that territory favors us; were we divided into a number of small countries we should be no better in this respect than Europe, but here we have an extent of territory 3,000 miles from west to east. The writer in the New York *Sun* very modestly (?) admits, first, that he don't know much about the weather, but this much he does know "that most of our storms come from the tropics." It is evident that this man does not see the weather-map, for if he did he would not have made such a statement. The weather-map shows the storm-centres ("Low") appearing in the west and taking their course toward the east sometimes on one line of latitude and sometimes on another, and not unfrequently changing from the south to the north, and even the reverse, as they advance. For the past six months not more than two or three have apparently come from the south, and indeed only one may be said to have come direct from the tropics, that which centered over Charleston, S. C., on the 27th of August, and which on the 24th was reported to be at St. Thomas, with a direction toward our coast.

We are wanting in stations in this quarter of the globe, so we cannot explain the course of such "Lows," yet from the similar course of many over the United States, I am under the impression that when one of these "Lows" comes up from the south, taking so nearly a due north line, it is simply an erratic course of a "Low" that was travelling on some southern line, as we frequently see in the United States. It not unfrequently happens that a south "Low" with us, one that is picked up in Texas, instead of keeping on a straight or comparatively straight line, takes a line for 1,500 miles almost due north. This being the case where we have stations and can prove it, does it not seem that it may likewise be the case with these erratic "Lows" which once in a great while come up direct from the West Indies?

Storms not coming from the tropics, where do they come from? Nowhere. This may seem queer to the reader, and he may say, What! such a positive thing as a storm come from nowhere? Yes, so far as *locality* is concerned. The storm comes from "Low" or is caused by the centre of the area of low barometer. But where does this come from? may be asked. These pages have explained over and over again, that "Low" is the concentration of the Sun's rays, best represented by a magnifying glass (double convex lens) so held as to throw upon a sheet of paper a ring of light which being moved over the paper well illustrates the movement of "Low."

From what information we have it is quite evident that this area of "Low" continually travels around the world, on irregular lines toward the rising sun. These "Lows" appear in the west, sometimes on a high line, sometimes on a low line, and, as repeatedly said in these pages, travel on various lines toward the east. Wherever they are there will the storm be, and without them there can be no storm. *This is where the storm comes from.*

The Peculiar Mission of "High."— A number of times I have said that in "some future paper I would more particularly refer to 'High,'" but somehow or other "High" has always been crowded out by "Low," and yet it performs a most important part in our meteorological economy; generally not so important as "Low," yet once in a while it plays a most important part and changes the whole aspect of a storm, modifying it or changing its course in such a manner as to create an entirely new condition of things—making it pleasant weather where the day before it indicated a storm, and sending a storm when the day before it would seem that pleasant weather would be the order of the day. "High" travels as regularly from the west toward the east as "Low." When "Low" is in the south it is cold, but if perchance "High" lies in an extended line east and west, the north wind will not be far from the north, therefore not very cold. When "Low" is in the north and "High" holds the same relative position in the south the wind will not be so very warm; in other words "High" acts like a barrier—like a high wall and shuts off the heat or cold as the case may be.

Then if "High" is immediately in front of "Low" as the two are moving toward the east, it will retard "Low" so its speed will not be so rapid. Again, as in the Chicago snow-storm of the 19th of March, 1881, two "Highs" may be near together and the space between them act like a huge cañon, which increases the speed of "Low" as it is drawn toward the narrow file that separates them, or its course be altered, as in the case of the "Low" that centered off Charleston, S. C., on the 27th of August, 1881. August 26th and 27th "High" was moving off the coast from Virginia to South Carolina. Notwithstanding this, it was expected that the "Low" from St. Thomas would follow the Gulf Stream along the coast—danger signals were ordered along the line. But from this point "Low" moved very slowly. "High" not only held it in check but was of sufficient power to deflect it to the northwest, and we saw, what is quite uncommon, "Low" reversing its course—traveling toward the west! And this it contin

ued to do, the while struggling to regain the easterly course, till the 31st of August when it almost disappeared, yet on the first of September it regained its strength and direction and with great speed went on a high line toward the east, creating thunder-storms and making it very hot on the line of its course.

Such are the freaks of "High" and the manner in which it not only unfrequently becomes the *positive* in the place of the *negative* element in a storm.

The storm of the 27th of August at Charleston well illustrates the absurdity of attempting to foretell the weather weeks and months in advance, and how the world—all who will not heed the weather-map—may be deceived by some ignorant "weather-prophet."

Mr. Vennor has complained that the *press* of the country has not done him justice, though probably there never was a man for whom the *press* has done so much; and that too when to take his part was to expose their own ignorance.

When a man puts himself on record in public print he establishes something whereby he must stand or fall. If what he says be sensible and true it will be of credit to him, if on the contrary he states that which is absurd and erroneous, it is the most powerful means whereby he can bring discredit upon himself, perhaps not immediately, but most surely when the world is advanced sufficiently to judge the matter.

On the 25th of September, in the Boston Sunday *Herald*, Mr. Vennor in a long letter made the most absurd claims for the work of the year and wound up by claiming the storm which came up from St. Thomas and centered over Charleston, S. C., August 27th, because he had said that on the "25th and 26th of August there would be storms on the lakes and around New York." He was, he said, only a little off on dates and locality, but it was the storm (!).

People not familiar with the weather map cannot see or understand the full absurdity of this claim, any more than if they were unfamiliar with the geography of the country, and some one should tell them that Charleston, S. C., was on the St. Lawrence; yet geographically it would not be a greater mistake to place Montreal on the South Carolina coast, or Charleston on the St. Lawrence, than meteorologically for a man to claim that the storm that was over Charleston on the 27th of August was identical with the one that Mr. Vennor said would be, but was not, over the lakes and St. Lawrence on the 25th and 26th.

Not only Mr. Vennor, but all would-be meteorologists had better study wel the weather-map ere they put themselves on record as weather-prophets. Th weather-map is one of the grandest incentives to science the world ever knew and it is the *only medium* whereby we may understand the weather. It is one o the strangest things in the world that the intelligent classes so neglect and com pletely ignore this; the only instrument and medium whereby they can study th geography of the atmosphere. The files of this map in years to come will put t shame all weather-prophets and their absurd systems. It would seem if the had any regard for the future that they would see this and would discontinu their absurd publications.

WASHINGTON, D. C., December, 1881.

SCIENTIFIC MISCELLANY.

A PLEA FOR NATURAL HISTORY MUSEUMS.

BY PROF. S. H. TROWBRIDGE.

In a previous article,* the absolute necessity of natural objects for the purposes of school and college instruction was set forth in the words of practical and experienced men who had every opportunity to know whereof they affirmed. In this, I shall attempt to show, by a somewhat similar array of authorities, their value to the community at large, and especially to thoughtful persons who have gone beyond the education of the schools.

To the increasing number of those who give especial attention to the study of science, the effort to impress the importance of natural history collections may seem superfluous. Not so, however, to those who teach it. And while there is a more or less vague idea in the minds of many that the study of nature has in it somewhat of interest and a little of profit, something more is needed to give its value greater prominence and make more real and tangible its interest. There are too much pleasure and profit in it to be lost for the mere lack of a little appreciation, when this can be so readily acquired. The fact that the State of Massachusetts and the friends of the Museum of Comparative Zoölogy have contributed over a million dollars to this means of popular instruction ; that a vast amount has been devoted to the Museum of Natural History in Central Park, New York, and also to the National Museum at Washington ; that museums of varying size and value are accessible to the public in all the best universities and colleges of the land ; and that zoölogical gardens, at great expense, are founded, maintained and well patronized, in most of our large cities, shows that there is some popular appreciation of such collections. Showmen, like Barnum and others, know, from the popular interest in animals, how profitable paid exhibitions of them in museums and menageries are. And even circus managers are shrewd enough to anticipate the public taste and provide for its gratification by attaching menageries to their performances, in order to attract those who crave something more profitable and instructive than mere amusements, as well as to give moral weight to a business sadly in need of it.

The safety of our land is in the education of its people. But interest and attention must first be excited before the mind can receive and comprehend valuable information. One's interest in any object is just in proportion to what he knows of it and does for it. Ancient Rome had her baths and gymnasia for the benefit of her people, and the national games of the Greeks were instituted for a

*This REVIEW, October 1881. "Science Teaching."

similar purpose. Heathen culture of past ages ought not to shame the intelligence of the present day. The committee appointed to establish a memorial to the late Prof Louis Agassiz decided that "The most fitting memorial must be the completion of his life's work. The completion of the museum in accordance with his plans and its liberal endowment, would be of infinite value to the educational interests of the whole country." Dr. Newberry, State Geologist of Ohio and Professor in Columbia College, New York, says in regard to natural history collections: "To the public at large they arrest attention and excite interest, the first step toward scientific education in the individual or community." The late Joseph Henry, of the Smithsonian Institution, also says: "They are well calculated to arrest attention and give definite impressions." Dr. Winchell, of Michigan University, says: "A donation of natural history specimens is a monument not only *aere perennius* but *aere utilius*. Would that our people might learn, like the Germans, to place less faith in brick and mortar, and more in books and the materials of science." Seeing a thing impresses the mind more forcibly than reading or hearing about it.

Ward's gigantic restored mammoth, as large as a house of moderate size, and his casts of monstrous animals of ages past, are grand educators because they call attention to natural objects and excite a desire to know their history. None can look upon them without astonishment and increased mental activity. Less striking specimens are, in their degree, equally potent in the same direction. A complete series of natural history specimens gives an ordinarily thoughtful spectator, or even a casual observer, many ideas in regard to the classification and relations or affinities of past and present organisms, their geographical distribution and grouping in different localities, and many other facts which can hardly be obtained in any other way. In short, it gives ample illustration of all that science has thus far deciphered of the plan of creation. The Agassiz memorial committee say: "The Museum he labored for is a presentation of the animal kingdom—fossil and living—arranged so as to picture the creative thought. The study of such a subject is the highest to which the human mind can aspire." A good museum should show, first, as full a representation as practicable of all the quadrupeds, birds, fishes, insects, plants, and fossils, which together constitute the complete fauna and flora of the vicinity in which it stands, and then, as soon as possible, of the whole territory represented by its friends and patrons. Its collections in botany should illustrate every obtainable peculiarity of vegetable structure, in wood, bark, root, leaf, flower and fruit. In the line of zoölogy there should be a full showing of the whole animal kingdom. In agricultural sections especial attention should be given to entomology, than which nothing can be of more interest to grain, fruit and vegetable cultivators, who lose millions of dollars annually by the ravages of insects. The cabinet should associate with the various noxious and beneficial insects, in their several stages, the food on which they live, their parasites and victims, so as to *present to the eye* an instructive history of each, such as every farmer's son, to say the least, should be familiar with. The mineral and fossil collections should show the characteristics of every

group of rocks in that section of the country, so one could hardly fail to *see the plan* in the order of creation, could see where coal may or may not be found, and also determine the probable presence or absence of iron, lead, zinc, baryta, ochres, clays, etc. A complete museum would also show the plants, animals, fruits, and other products from every quarter of the globe, so one in reading about different countries, or who has a special interest in some one, can see what organisms belong there and can get a good idea of the country without going to see it.

The wanton destruction or waste of valuable scientific material is a matter for very serious consideration. This unintentional, though not less impoverishing vandalism, is lamentably frequent and prevailing. Skeletons, pottery, stone and flint implements, and other remains of our pre-historic inhabitants are frequently plowed up in the fields. They attract a moment's notice, perhaps are picked up, then laid away and forgotten, or more frequently are crushed and scattered by the plow till they are rendered utterly worthless. Mastodon and other remains often share the same fate. It is exceedingly trying to the sensibilities of a lover of nature to see the almost criminal carelessness of the unappreciating possessors of these instructive objects, Sometimes they are held, from some indefinable fancy, with a tenacity which might argue a love of nature, and yet the way the precious things are abused and ruined dispels at once this charitable delusion, and is often enough to stir up the righteous indignation of a saint. May not the lover of science under these circumstances obey the command of Scripture, "be ye angry and sin not." Among several somewhat similar experiences, the writer distinctly remembers one in which a student solicited a valuable specimen for him as curator of a growing museum, and was indignantly refused with the statement that the owner thought more of the specimen than of the curator. Yet its beautiful angles and faces were destroyed and the whole ruined by the knocks and kicks it received by being tumbled about in a dingy out-building. In nearly every home, or about it, objects of scientific value are to be found lying about where they are liable to be injured and lost. They are doing nobody any good, yet they could readily command valuable returns to those possessing them, and at the same time would contribute very greatly to the interest of people in science and, hence, to its rapid advancement. These are held as curiosities or given to children for their amusement; and whether held by young or old, if they elicit no thought or study, and create no knowledge or inquiry concerning their history, they are merely *children's toys*, affording no profit—simply idle amusement. A child can be amused with either a watch or a jumping-jack to play with; but the latter is more economical and equally effectual. These valuable historic objects, as mere curiosities, in the hands of old or young, are virtually watches for children's playthings instead of jumping-jacks. It may be of interest to such delighted owners to know that all scientific material has a certain money value—"a value which," says a dealer in this material, "can be as surely and as speedily realized as that of any description of property." Holders of such specimens can also exchange them, with any well-stocked museum, to mutual advantage, for

others not so easily obtained in their vicinity and thus, in time, form a collection while not less amusing and attractive, much more varied and instructive. Material thus received can easily be accompanied with instructive facts concernin its position, relations, habits, etc., which will be doubly valuable because the stimulate thought as well as furnish pastime and amusement.

National and State governments make laws to protect fish, birds, etc., a certain seasons of the year for a greater public benefit at other seasons. The should also provide some way of preventing the destruction and misapplication c archæological and other scientific material, so it may be legitimately employed fo the advancement of science and for the increase of popular intelligence. Th Danish government requires that scientific collections made on its territory sha be deposited in the national museums. A scientific commission in England i intended to accomplish a similar end there; and such a commission or depar ment in our government is a consummation devoutly to be wished, and one whic the growing intelligence of our people will doubtless, at no far distant day, de mand and then supply. May friends of science and of national progress spee the day.

Museums are also of great advantage for encouraging and fostering origin investigation. As the question of evolution or of creation is racking the whol scientific and religious world, and is so largely to be settled by having an un broken series of all life in chronological order for examination, the vast impo tance of extensive collections of fossils can hardly be over-estimated. A writer i the *Advance*, some time ago, said: "The science of geology, dealing as it do with the only visible record of any considerable age, in regard to the history o life upon our planet, must settle the vexed questions—if they are ever to be settle —of the origin of species, the antiquity and perhaps the unity of man. To man the acceptance of the new theories on these points is equivalent to legislating Go out of the universe. If so many are wrecked upon these questions, the corre understanding of them is a matter of no little importance." Mr. Agassiz h said, "The question of the geographical distribution of animals lies at the ve bottom of the question as to their origin." This must be shown by com plete faunal collections from all localities, which can be seen only in larg museums. Museums are valuable, too, for studying the life history of vario animals, when a large series of allied forms, showing the variations of life, hal and characters, are accessible for comparative study. Here the investigator oft learns that forms which were supposed, from their lack of resemblance, to repr sent different species, are connected by a regular gradation of similar forms a are really the same. A large series is often necessary to enable the investigat who is studying new or rare forms of which perfect specimens are seldom see to determine the species, relation of parts, size, shape, etc., of the complete a mal. One fragment will supplement another, throwing new light in various wa and thus furnish material for the restoration of the complete animal.

Questions of practical importance are continually arising in regard to one another of nature's products which, for lack of sufficient data at home, have to

sent, at considerable expense of time and money, to distant museums for investigation. Because of this necessity many facts of vast financial importance are never gained. Men will not take the trouble to send to a distance for knowledge whose value is not adequately comprehended on account of its very distance. Dr. Dana, of St. Paul, says: "It is utterly chimerical to think that Western men can look to Eastern institutions for higher education. The latter is the vital function of every commonwealth, and can no more be transferred than its political responsibilities. For the West to rely upon the East for liberal education, would put her, according to Dr. Post, 'in the attitude of France in relation to Paris; of vast and inert provinces feebly feeling the pulse of the distant and intellectual capital.'" So far as possible, each State should have so complete a museum that no student of nature would be compelled, for anything but the most exhaustive study of unique specimens, to seek facilities for study in a distant college or museum, but could find at home collections which would attract students of science, practical scientists, and unscientific men needing scientific information, from every quarter. A collection of specimens from Kansas was recently taken to Agassiz's museum, in Cambridge, Mass., to be identified and classified, for want of facilities at home. To the same place also were shipped, for a similar purpose, materials by the ton from the Kentucky Geological Survey. Material of like character and amount is stored within the limits of Missouri, with little knowledge of its value, from lack of facilities for determining it here. Other material from this State is now in the Archæological Department of the Smithsonian Institution, by request of authorities there, because of the peculiar richness and value of the objects which this State affords. And this is by no means the first time that scientific material from Missouri has been solicited for study in Washington, Boston, and other favored cities of the East. Yet, unfortunately, vast supplies of all such material throughout the State are allowed to "lie here ungathered and waste upon the plains." Much of this material is new to science, and is rich in suggestive questions that have never been answered, but which might and should be solved by her own citizens and upon her own soil.

Again, museums are of vast importance in giving us increased knowledge of God and his works, as does the Bible. Nature, not less than scripture, is a revelation from God. Each was designed to supplement and complement the other. Neither can be understood in all its fullness without illumination from the other.* Mr. Agassiz has said: "Collections of natural history present the plan and mind of God in creation." "If I mistake not, the great object of our museums should be to exhibit the whole animal kingdom as a manifestation of the Supreme Intellect. The time is past when men expressed their deepest convictions by wonderful and beautiful religious edifices; but it *is my hope to see*, with the progress of intellectual culture, a structure arise among us which may be a temple of the revelations written in the material universe. If this be so, our buildings for such an object can never be too comprehen-

* For illustrations of their mutual helpfulness, see "The Bible and Science," this Review, October, 1880.

sive, for they are to embrace the infinite work of Infinite Wisdom. They can never be too costly, so far as cost secures permanence and solidity, for they are to contain the most instructive documents of Omnipotence." The late Prof. Orton says: "A cabinet unfolds the great idea of God as it marched on to realization. To the theologian, philosopher and student, it is a vast repository of thoughts and suggestions to which the Astor Library is nothing." In a notice of the Ward Cabinets, we read: "No one can enter this truly cosmological museum without believing that he has before him, in one volume, God's narrative of creation. For he who classifies the results of those six days of labor by the erection of a complete repository of natural objects in natural order, is a translator of the Creator's thoughts." A well selected and arranged museum presents to the eye, in physical form and in minuter detail, the panoramic view of creation which Moses expressed in words. In one of his talks to his students, at Penikese, Mr. Agassiz said: "The study of nature is direct intercourse with the Highest Mind. It is unworthy an intelligent being to trifle with the works of the Creator. A laboratory of natural history is a sanctuary, in which nothing improper should be exhibited. I would tolerate improprieties in a church sooner than in a scientific laboratory."

Since nature is another revelation from God, why should not facilities for studying her in good museums be as worthy an object of Christian liberality and the use of consecrated funds as the erection of churches and the distribution of Bibles? Christ commonly impressed his truths by illustrations from some phenomena of nature. And religious teachers would do well to pattern after their exalted Model and know nature better for increased power in their work. The time is doubtless not far distant when theological seminaries, as well as colleges and universities, will be required, by the demands of the times, to have collections specially adapted to teach the order of creation and to illustrate the vast number of scientific allusions in the Bible; and also to have competent professors who are especially qualified to bring out in full relief the scientific phases of Bible truths and the Scripture phases of scientific truths.

In a Missouri publication, it is not inappropriate that this article should have somewhat of local application. The State of Missouri, the geographical centre of the Union, than which no State has been endowed by nature with vaster and more varied stores of animal, vegetable, and mineral wealth; with fertile fields of science ripe for the harvest in all the adjoining States; with ready access to the Rocky Mountain regions containing the richest stores of scientific material in the known world, to the Mexican Gulf rich in recent animal life, and to Texas equally rich in remains of ancient life; and midway between the two great oceans that wash our shores, is peculiarly favorable for the seat of a large museum. There is no apparent good reason why in Missouri may not be accumulated collections, in all lines of popular, practical, and scientific interest, which shall afford every desirable facility for improvement, instruction, and original research, be a credit to friends and a source of profit to our citizens, an honor to the State, and a valuable contribution to the advancement of science everywhere.

That the formation of such collections, both living, in zoölogical and botanical gardens, and dry, in cabinets and cases, is practicable is capable of easy demonstration. As has already been intimated, this State abounds in specimens which are prized and solicited by curators of museums, collectors, and students in all parts of the United States. Many private collections of great value have been accumulated here, almost entirely by the efforts of the individual owners, with but little expense and less outside assistance. The richest of these have been in the line of Indian relics, in which this State is remarkably rich, yet its wealth has been but very imperfectly explored; also of fossils, minerals and plants. Unfortunately for the credit and welfare of our State, some of the most valuable collections found here have gone to enrich eastern museums on both sides of the Atlantic. They should have been kept here and could have been, had they been properly appreciated. With a full supply of home material, and sufficient assistance in preparing it for scientific use, duplicates can easily be exchanged for valuable material in abundance from other collections from distant localities representing forms which are not to be found here. Unfilled applications for specimens from this locality, with tempting offers in exchange, are constantly in possession of both professional and amateur collectors here. Systematic collections and cabinets, labeled and arranged with care, are always to be purchased for a reasonable sum. These range in price from that of Ward's magnificent collection of casts, representing most of the extinct animals and plants that have inhabited the earth, costing thousands of dollars, to choice cabinets of birds at a cost of fifty to three hundred dollars, even to fine suites of shells, minerals, plants, etc., for a dollar or more. Expeditions can also be fitted out at moderate expense which will rapidly increase the material needed.

Friends of such a museum and of science can readily be induced to present collections of large or small amount, obtained by purchase or otherwise. This will vastly augment the pleasure and profit they derive from the museum, and their pride and interest in it, as well as *its* facilities for contributing to the pleasure and profit of the community at large. It is interesting to see how contagious is the spirit and practice of contributing to a good cause. One can easily provoke others to good works. And the possession of a considerable nucleus is almost sure to attract donations in greater number, illustrating the doctrine of Scripture—and of human nature as well—that "to him that hath shall be given," and demonstrating the truth of the trite maxim that "nothing succeeds like success."

BOOK NOTICES.

NEWFOUNDLAND TO MANITOBA. By W. Fraser Rae. 12mo pp. 294; with maps and illustrations. G. P. Putnam's Sons, N. Y. For sale by M. H. Dickinson, $1.25.

This is an account of a trip from Newfoundland, via Halifax, across the Dominion of Canada, into the Province of Manitoba, in the autumn and winter of 1880, by the writer, who was at that time a correspondent of the London *Times*.

It is made up of statistical and general information concerning the resources and advantages of Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island, the Red River country, Manitoba, New Iceland, the northwest Territories and the Canadian Far West. And to the ordinarily informed reader the facts detailed will be astonishing. Few people realize that even in Newfoundland, which lies between 45° and 55° north latitude, fair crops of barley, oats, turnips and potatoes are grown, while grass and consequently, cattle and sheep, flourish luxuriantly. Nova Scotia, is better known from Longfellow's Acadian scenes in "Evangeline," than from almost anything else, as an agricultural region, but is not generally credited with being the productive mining country that its statistics prove it to be. Coal and iron are largely produced, while the amount of gold mined in the auriferous area of 3000 square miles, is quite considerable.

As we proceed westwardly with our traveler we are in turn impressed with the extent of the lumbering and cattle trade of New Brunswick, the immense mackerel and lobster preserving industry of Prince Edward Island, also her potato crop, amounting some years to 3,500,000 bushels, the comprehensive system of railways of the Dominion, the exceedingly valuable copper and silver mining regions along Lake Superior, the unequaled mammoth farming in the valley of the Red River of the North, within the borders of the United States, and its lovely scenery outside of the boundary line most of the way to Winnipeg, the capital of Manitoba.

Winnipeg is described as a well-built city of 15,000 people, with churches, stores, custom house, an university and academies and an Historical and Scientific Association.

Manitoba itself is a vast dominion, larger than any State of our Union, except Texas and California, and possessing most of the advantages and excellences of Minnesota. One scourge noticed by Mr. Rae is the locusts or grasshoppers, which have appeared there thirteen times since 1812. In short, Manitoba is the "Prairie State" of Canada in all respects.

Mr. Rae is an interesting writer and his book will be of great service in developing the regions described and of which, comparatively, so little is known.

A Manual for Commissioners of the Circuit Courts of the United States. Prepared by Warren Watson. Callaghan & Co., Chicago, 1882.

Mr. Watson has been Clerk of the Western District of Missouri for a number of years and has acquired a familiarity with the forms of practice not readily attained otherwise. Not only are all the duties and powers, qualifications of commissioners, systematically and clearly set forth, but all the forms used in proceedings before them and the opinions of several of our best Federal judges touching doubtful points in connection with the office, in full in this Manual.

A second edition having been so soon called for is an evidence of its value to the profession.

Transcendental Physics. By Johann Carl Friedrich Zöllner. Boston; Colby & Rich, 1881.

This is an account of experimental investigations in spiritualism by the author, translated from the German by Charles Carleton Massey, a barrister-at-law, of London, who also furnishes a comprehensive preface to the work.

In this preface he regrets the indisposition on the part of the public to see in the alleged phenomena of spiritualism a simple question of evidence, and claims that it is only from this point of view that it should be regarded, since the only elements of fallacy possible to be added by testimony, to original observation, are such as may result from defects of veracity, defects of memory, defects of judgment and defects of language, or the understanding of it by the recipient of the testimony. He also asserts that, to himself at least, so-called spiritualism represents no religious craze or sectarian belief, but an aggregation, (not yet to be called a system) of proven facts of incalculable importance to science and speculation Those who so regard the subject would adhere to their convictions of its truth and importance even though it were shown that every medium was a fraud and many spiritualists their willing dupes. Much of the evidence upon which they rely was taken on that very assumption, and the precautions taken had these suspicions in view.

The readers' attention is called to the work of Prof. Zöllner by the translator as a volume of facts and evidences, and all that is asked by him is "a fair judgment on the facts themselves."

Turning to the author himself, we find a discussion of Gauss' and Kants' theories of the four dimensions of space and a suggestion that the explanation of such acts in spiritualism as table-tipping and moving, tying of knots on endless cords, etc., may be found in the theory that "spiritual beings may exist in space, and the latter still remain penetrable for material beings, because their presence would imply an acting power in space, but not a filling of it, *i. e.*, a resistance causing solidity." These spiritual beings he calls "four-dimensional," and claims that "an intelligent being having the power voluntarily to produce on an endless cord four-dimensional bendings and movements, must be able without

loosening the seal to tie one or more knots in this endless cord," and so of all the other phenomena of spiritualism.

The book is filled with results of all manner of experiments in magnetism, chemistry and physics, which, whether attributable to spiritual influences or not, are quite inexplicable. After all, however, is it strictly logical to draw this particular inference from an inexplicable set or series of facts? Is the evidence so complete and full as to fasten upon the spirits, indisputably, the origination of these mysterious circumstances and occurrences? Taking it as a matter of proof alone, as our author and his translator desire, we fail to be convinced of the accuracy of their conclusions. At the same time it is not a subject to be lightly brushed aside. The facts given in this book, and known to all of us, lead somewhere, and it is the duty of educated and skilled scientists to follow them to their legitimate and sure conclusions, whatever they may be.

OTHER PUBLICATIONS RECEIVED.

Catalogue of the fossils of the Cincinnati Group, by Jos. F. James, Custodian Cincinnati Society of Natural History; *Ward's Natural Science Bulletin*, Rochester, N. Y., quarto, monthly, 50 cents per annum; Some New Compounds of Platinum, by F. W. Clarke and Mary E. Owens, University of Cincinnati; An Abstract of the Results Obtained in a Recalculation of the Atomic Weights, by Prof. F. W. Clarke; An Account of the Recent Progress in Anthropology for the years 1879 and 1880, by Otis T. Mason; The Palæolithic Implements of the Valley of the Delaware, reprinted from the Proceedings of the Boston Society of Natural History; Boulder County as It is, by John K. Hallowell, published by Colorado Museum of Applied Geology and Mineralogy, 15 cents; Minnesota Medical Mirror, Monthly, N. M. Cook, M. D., $1.00 per annum; Proceedings of the Boston Society of Natural History, Vol. 20, part 4 and Vol. 21 part 1.

EDITORIAL NOTES.

THE test made at Philadelphia, on the 5th ultimo, of the telegraph and telephone lines of the Underground Electric Company was declared eminently satisfactory. The stations were one mile apart and the slightest whisper could be heard from one to the other, and the solenoid or *metallic circuit* was pronounced far superior to the ground circuit.

PRESIDENT ARTHUR'S remarks upon polygamy have aroused, all over the country, renewed and concerted opposition to it. It is, however, unnecessary for the people of this county to take any such action, since they "put themselves right on the record," more than forty years ago, by rising *en masse* and driving the Mormons from her borders

THE Kansas City Academy of Science, through the courtesy of the Board of Education, will hereafter hold its meetings and keep its library and collections at the Public School Library room at No. 548 Main St.

THE meeting held here in behalf of the Garfield Memorial Hospital, to be erected at Washington City as a "cenotaph to the illustrious dead and a haven of health to the living," was well attended, and a committee appointed to solicit subscriptions. It was decided not to ask more than one dollar from any one, so that all classes might have the privilege of assisting in this tribute to the memory of the departed President. Col. Theo. S. Case was selected as Treasurer, to whom the contributions of those not called upon by members of the committee may be sent.

A BILL has recently been introduced in Congress granting the right of way, two hundred feet wide and three hundred yards on either side, for a canal across Florida and part of Georgia, connecting the Atlantic and the Gulf of Mexico, for the passage of steamboats, barges and light-draft ocean vessels.

CAPT. BERTHOUD, pays his annual compliments thus: "I enclose $2.50 for another year's subscription to the KANSAS CITY REVIEW; long may it flourish! I get so much in it that does not appear elsewhere that I do not care much for any other journal of science."

THE Kansas City Smelting and Refining Company are out with an extremely neat circular containing an analysis of their refined lead and a picture of their works at Argentine, Kansas. Accompanying their circular is a foil of their refined corroding lead, pounded from a plate one-half an inch in thickness by 3,400 blows of a sledge-hammer.

PROF. G. C. BROADHEAD sends us the following note from Pleasant Hill, Mo.: "On Friday night, January 13, 1882, at 9:10 Jefferson City time, going northward on the street, a bright light as of a torch caused me to turn, and across my shoulder to the southwest I saw a bright meteor—brightest I ever saw at night—passing about 10° west of Orion, bursting and vanishing in three seconds, but showing very bright streaks, calling to mind the electric light—violet, red and yellow; it threw off sparks and streaks each way and disappeared; night clear, but little wind and cool.

THE rich Greek banker, Syngros, has contributed another 100,000 francs for the foundation of a national archæological museum at Olympia, where the relics of antiquity recently discovered are to be exhibited.

OUR old friend, Dr. J. M. DeBall, write as follows: "Permit me to congratulate you on the success of your magazine. I hope the *cash* side of the account is fully up to the literary position of the REVIEW."

SAN JOSE, California, is lighted by means of a tower two hundred feet high and mounting six Brush lights. The tower is built of gas pipe, one corner resting on each of the four corners of the intersecting streets.

DR. JOHN W. DRAPER, author of "Human Physiology," the "History of the American Civil War," "The Conflict Between Religion and Science," etc., died, January 4th, aged 71, at his home, at Hastings on the Hudson.

THE glucose works at Leavenworth, Kan., are now consuming 2000 bushels of corn daily, and four tons of coal; working seventy-five men, and shipping three car-loads of syrup per day, and feeding two hundred head of cattle with the refuse.

ON a sun-dial at Visp, Switzerland, is the following Latin inscription, "Omnes time propter unam," which some scientific wag translated somewhat freely, "All *time* goes by this." In the same vein we suggest the knowledge of nitro-glycerine by the Romans, from the following line from Horace, "Uritme *Glyceræ nitor.*"

A DETAIL has been made of a number of under officers of the navy to duty at the Smithsonian Institute with a view of adding to their course of training some matters pertaining to natural science which the Annapolis Academy does not give. They will then be expected when on duty to gather and furnish to the government whatever scientific information may come under their observation, so far as they are able, without neglecting their other duties. The German, Scandinavian, French and English navies have already such training, and have added to the scientific information of the world by their work. Our own navy, when aided by civilian scientists, has also done good work in this line.

THE Missouri Press Association meets this year on May 9th, at St. Joseph. An entertaining programme has been arranged, and the citizens and Board of Trade assure the members a cordial reception.

THE Eleventh Annual Live Stock Report of the Kansas City Stock Yards, for the year ending December 31, 1881, by E. E. Richardson, the very efficient Assistant Secretary, is not only a statement of the receipts and shipments for that year, but also a full and comprehensive comparative statement of monthly receipts and shipments of cattle, horses, sheep and hogs, by months, for the past eleven years; also the receipts and shipments over the various railroads centering here for the same length of time. From the report we cull the following items: Receipts for 1881: Cattle, 285,853; Hogs, 1,014,304; Sheep, 79,924; Horses, 12,592. Shipments for 1881: Cattle, 286,134; Hogs, 1,015.447; Sheep, 79,848; Horses, 12,604. Amongst the shipments are included those consumed in this city, viz: Cattle, 62,145; Hogs, 819,923; Sheep, 18,770; Horses, 2,548. The increase over 1880 is very large; the shipment and consumption of hogs, for instance, being 338,599, and other stock in about the same proportion. The total receipts since the opening of the yards have been: Cattle, 2,282,620; Hogs, 3,694,570; Sheep, 376,995; Horses, 76,898; a grand total of 6,431,082, of which a very large proportion, (that of the hogs being almost one-third) were received in the last year.

ITEMS FROM PERIODICALS.

THE Boston *Journal of Commerce* is a very able illustrated weekly paper, and as handsome as it is independent in tone. It has technical articles on workshop matters, tools, steam engineering and machinery. Its manufacturing intelligence of what is going on in the great centers is very full, and compiled especially for it.

THE Lawrence *Journal* says of the REVIEW, among other pleasant things, "The editor keeps his readers fully informed of the newest literature and the latest facts in the scientific and industrial world. The REVIEW is admirably sustained in all its departments."

THE Kansas City REVIEW OF SCIENCE AND INDUSTRY for January presents a table spread with the choicest fruits of scientific and industrial knowledge. * * * All of the departments are full of attractions to the scientific mind, and the editorial notes possess their usual excellence.—*Kansas City Journal.*

THE Leavenworth *Times* says that five sorghum mills are now running with good success in Kansas. The Ellsworth Sugar Company owns one hundred and sixty acres of land adjoining the city, and has a mill capable to turning out five thousand barrels of syrup per day. The capacity of the two mills at Sterling is nearly five hundred tons of cane per day. The mill at Larned has been in successful operation for the past two years, and has paid well. That near Great Bend, for the past season, after supplying the farmers of the neighborhood with syrup, had a surplus of forty thousand gallons, worth from forty to forty-five cents per gallon.

NUMBER 28 of the *Humboldt Library* consists of "Fashion in Deformity," by William Henry Flower, F. R. S. Octavo, 16 pp. illustrated, 15 cents.

THE Scientific Publishing Company of New York, publishers of the *Engineering and Mining Journal*, have commenced the issue of a new publication under the title of *Coal*, which is to be devoted exclusively to the coal trade. Monthly, $2 per annum.

THE KANSAS CITY REVIEW for January contains a great deal that is instructive and interesting. * * * These are not all the subjects of which this number treats, but they are sufficient to show the scope and nature of the REVIEW, which is an ably managed monthly.—*Boston Journal of Commerce.*

SENATOR A. R. GREEN, of Kansas, widely known as the *Journal* correspondent "Joe Fluffer," has prepared a lecture on "Ancient and Modern New Mexico," which has received great commendation wherever delivered.

THE Labette County *Democrat* says: "The Oswego Cotton Company are giving out quantities of seed nearly every day, and there is no doubt but that a very large a reage of cotton will be planted next year. It is estimated that two thousand acres will be planted in Montgomery County in 1882, and more or less will be planted in other neighboring counties. This crop is becoming a sure and profitable one in Southern Kansas.

THE London *Telegraphic Journal* signalizes its entrance upon its tenth volume by changing to a weekly publication and an enlargement of its pages. It is an excellent publication, keeping fully abreast of the times in all electrical matters. Price, $5 per annum.

WE learn from the *American Specialist* that the well-known firm of Lindsay & Blackiston, publishers of medical books for the past forty years, has been dissolved, and the business will henceforth be carried on by P. Blakiston, Son & Co., at 1012 Walnut Street, Philadelphia.

MR. HENRY BERGH occupies valuable space in the current number of the *North American Review*, in an absurd attempt to show that vaccination is not only useless as a preventive of small-pox, but even a source of serious injury to the human race.

KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. V. MARCH, 1882. NO. 11.

HISTORY.

EARLY NOTICES OF THE MISSOURI RIVER AND INDIANS.

(THIRD PAPER.)

BY JOHN P. JONES, KEYTESVILLE, MO.

Father James Marquette, who, in company with Joliet of Quebec, explored the Mississippi from the Wisconsin to the Arkansas, in 1673, did not mention the Missouri in his narrative of the voyage except under the name of Pekitanoui, but on his map accompanying the relation, the river is located for a part of its course, and in nearly their right positions the villages of the Missouri Indians are mentioned under the names of Ouchage (Osage), and Emissourites (Missouris).

This map is still preserved with the original relation in St. Mary's College, at Montreal, Canada, and bears, so far as I have been able to discover, the first mention by name of the Missouri Indians. That part of Marquette's map which refers to the country west of the Mississippi must have been based on information derived solely from the Indians, but subsequent investigations have proven its correctness. The first explorers of the Missouri found the tribes, located by Marquette on the course of that river, to be nearly as he placed them, which is as follows: Ouchage (Osage), Emissourites (Missouris), Kansas, Otontanta (Otoes), Maha (Omahas), Pana (Pawnees) and Pahoutet (Pah Ute).

Succeeding Marquette and Joliet, there came to the Illinois country in 1680, to explore the Mississippi Valley, Robert Cavelier, de la Salle, a true rover and ex-

plorer, self-reliant, strong in his own resources, too imperious and dictatorial in his manner to win the confidence of those under his command, but possessed of wonderful energy and a mind charged with grand schemes of western discovery, colored with expectations of pecuniary profit to himself and associates. After spending nearly two years in preparing for his voyage, making peace with the Indians, building forts, journeying to Canada and back, La Salle and his party consisting of twenty-three Frenchmen and thirty Indians, left the mouth of the Illinois River December 13th, 1681, and entered the Mississippi. Going down fifteen or twenty miles, they camped for the night within the limits of what is now the State of Missouri. Of this party, who two hundred years ago camped for a wintry night at the junction of the Missouri and Mississippi, three were destined to imperishably connect their names with the history of the valley, La Salle, Father Zenobius Membre, and Henri de Tontz. Of this voyage of La Salle's down the Mississippi there are six narratives, written by members of the expedition, though all of the writers do not mention this camping near the Missouri.

The most explicit account on this point is that of Nicolas de la Salle, whose narrative has lain in manuscript, unpublished, until the recent volumes of Pierre Margry brought it to light. The writer, though of the same name, was not a relative of the commander of the expedition, and at that time was quite a young man. Twenty years later he was made royal commissary of Louisiana, and filled the office for seven years, to the great annoyance of Governor Bienville, with whom he had many contentions. His narrative of the voyage down the Mississippi was written in 1685, and in it he says, "The first day we camped six leagues on the right side, going down the river near the mouth of a river which falls in the Mississippi; it is called the river of the Missouris. This river comes from the northwest and is thickly settled, judging by what the savages say. The Panis (Pawnees) are on this river very far from the mouth."

The location of the camp, as mentioned by this writer, would be within the limits of either St. Louis or St. Charles county, according as it was on the right or left bank of the Missouri. The most prominent member of the expedition next to its commander, was Henri de Tontz, son of the governor of Gaeta, a native of Italy. He entered the French army in 1668 and lost a hand which was supplied by one of iron, from which fact he was frequently called the "iron hand" by the Indians. He joined La Salle at Rochelle in July, 1678, and was among the few men admitted to the confidence of his commander. In his relation of the "Enterprises of M. de la Salle from 1678 to 1683," written at Quebec November 14, 1684, he recounts the voyage down the Mississippi, and says "The Indians having finished their canoes we descended the river and found at six leagues on the right a river which falls into the river Colbert, coming from the west and appearing as large and important as the great river. According to the reports of the savages, it is called Emissourites, is abundantly settled with people. There are also on this river villages of savages, which make use of horses to go to war and to carry the meat of the buffalo which they kill." The nation thus referred to was the Pawnees and though they were located far in the

interior they seem to have been early known to the French. The fact that they possessed horses was frequently alluded to by early French annalists. In the account quoted it will be seen that Tontz does not mention that the party camped near the Missouri, but does corroborate M. de la Salle in all other particulars. In the year 1693, nine years after, he addressed a memoir to the King of France, setting forth his services in the valley of the Mississippi, and especially reciting his undertakings in connection with La Salle. In giving an account of the first voyage down the Mississippi, he says, "We descended the river (Illinois) and found six leagues below on the right, a great river which comes from the west, on which there are numerous nations. We slept at its mouth. The next day we went on to the village of the Tamaroas six leagues off on the left." Here it will be seen that Tontz agrees with the young La Salle as to the place of camping on the night of December 13th, though from his language the inference could be drawn that the party spent the night in their canoes, were it not for the positive language of his companion, who says they camped.

La Salle's antipathy to the Jesuits was so great that he would allow none of them to accompany him on his expeditions, but chose his spiritual advisers from the medicant order of Recollects. Two of these friars accompanied him to the Illinois country, Louis Hennepin and Zenobius Membre. The former was sent in February of the preceding year to explore the Mississippi north from the mouth of the Illinois and was taken a prisoner by the Sioux, while the latter accompaned the expedition south from the same place, and has left two accounts of the voyage. In one, which is in the form of a letter dated June 3, 1682, no mention s made of any stop in the vicinity of the Missouri. In the other, which is by ar the best account of the voyage in existence, he says, "The floating ice on the iver Colbert kept us at this place (the mouth of the Illinois) till the 13th of the ame month, when we set out and six leagues lower down found the Osage (Misouri) coming from the west." He makes no mention of stopping, in direct erms, but continues his narrative as follows: "On the 14th, six leagues further ve found on the east the village of the Tamaroas who had gone to the chase." he inference to be drawn from this language, is that expressed by Tontz who ays of the Missouri, "We slept at its mouth." As the reverend father says hey found the river on the 13th and the Tamaroas on the 14th though they were ut six leagues apart, he does not intend to convey the idea that the night of the 3th was spent in traveling.

The remaining account of the voyage is found in the *proces verbal* of the aking possession of Louisiana, made by James de la Metairie, at the mouth of e Mississippi, April 9, 1682. Metairie was a notary from Fort Frontenac acompanying the expedition, and while it seems to have been the intention of La alle to claim possession of the whole territory watered by the Mississippi and s branches, the notary is very obscure in his enumeration of rivers and Indian ations. This defect probably arose from an ignorance of the geography of the ountry. He does not mention the Missouri River at all, but contents himself ith saying that they left the Illinois river on the 13th of December, 1681, and

arrived at the village of the Tamaroas on the 14th. From the extracts given, it is conclusively shown that La Salle and his party spent one night on Missouri soil, on their voyage to the sea, whereby France gained an empire and the world its first knowledge of the mouth and full course of the Mississippi. Conceding that De Soto's expedition reached the New Madrid country in 1542, this visit of La Salle's party in 1681 was the second in point of time made by white men to the country comprised within the borders of our State.

The Missouri and Illinois Indians, though of entirely different stock and living two hundred miles apart, were always on very friendly terms, as I have shown in a former paper. Another incident bearing on this is found in an encounter mentioned by Tontz in his account of the return of La Salle's party up the river. After mentioning that La Salle had been left at Fort Prudhomme sick, and that he had been directed to push on with the main part of the company, and that they had passed the mouth of the Ohio, he says: "Four days after I perceived a smoke and went to it. There came out of the forest thirty Tamaroa warriors with bows bent, making their war cry at us. I presented the calumet to them and one Illinois who was among them having recognized me exclaimed, "It is my comrade, they are French." We landed and passed the night with them. They designed to kill us, but as they were part Illinois, Emissourites and Tamaroa, the Illinois prevented the attack." Here were the Missouris visiting the Tamaroas and uniting with them to go on the war-path. Tontz speaks of the Tamaroas as though they were a distinct tribe, when in reality they were a branch of the Illinois, who had established their village on the banks of the Mississippi. Those familiar with the history of the trials endured by La Salle in his endeavors to establish a colony on the Illinois River will recollect the loss of his vessel, the Griffin, containing the greater part of his stores, and how he suspected that the pilot had purposely wrecked the vessel and taken his goods to the Sioux country intending to establish himself as a trader. From letters written at the time, but only recently published in the Margry volumes, it appears La Salle was of the opinion that his pilot had been captured and held as a prisoner among the Missouris and other tribes west of the Mississippi. In a letter dated Chicago Portage, June 4, 1683, to M. de la Barre, the newly appointed governor of New France, he gives an account of a story told him by an Indian lad, as follows: "The lad had been taken by the Pawnees, then by the Osages, who had given him to the Emissourites, and they to the nation from which I had him. He told us several times that he had seen two Frenchmen, three years ago, prisoners among the Matchinhoa, whom he described to us in such a manner that I could not doubt but one of them was my pilot, that they had been taken in the Mississippi River, which we call Colbert, ascending toward the Sioux, with four others, in birch bark canoes, loaded with merchandise, among which were several large grenades such as I had left in the barque; that the pilot had exploded one in the presence of one of these barbarians, and having made them understand that with similar ones he would burn the villages of their enemies, if they preserved his life. That he did not yet understand the language of those with whom

he was when my little savage saw him. They had come in peace to the village of the Missouris where he then was and exploded a similar grenade." If it were possible to verify this statement of the Indian lad, it would establish the date of the first visit of white men to the Missouris, but unfortunately, though La Salle gives additional circumstances which he supposes relate to the captivity of his pilot, and reiterates the whole story in other letters, the evidence is far from conclusive that his pilot was ever among these Indians, either as a captive or otherwise.

La Salle's aversion to the Jesuits often led him to extremes, and his dislikes of others frequently placed him in an unenviable light.

He was at emnity with Louis Joliet over matters which had occurred at Quebec, relating to the fur trade. Frontenac, La Salle, La Forest, Du Sheet and others, were ranged on one side and Joliet, Bienville and brothers, the intendant Duchesneau and others, on the other. I haven't space to explain the quarrel, but refer to it to show the animus of what follows. Joliet had been associated with Marquette in exploring the Mississippi, and on his map of the country, over which they passed, had made an endorsement approving the route to the Mississippi by way of the Chicago portage to the Illinois river. This approval by Joliet drew the condemnation of La Salle before he passed over the route, and in several of his letters, he took occasion to refer to the impracticability of it. In one recently published by Margry, he says: "The waters being always low in the month of March, it would be easier to effect the transportation from Fort St. Louis, (on the Illinois) to the lakes by land; by making use of horses, which it is easy to have, there being numbers among the savages called Pana, Pancassa, Panimaha and Pasos, at some distance, to be sure, to the westward, but with which an easy communication may be had, either by the river of the Missourites which empties into the river Colbert, if it be not the principal branch of it, and is always navigable for a distance of more than four hundred leagues to the west, or by land, so bare is the country between these people and the river Colbert, that it is a wide prairie by which they may be easily brought overland."

I have quoted this to show to what extremes La Salle was willing to resort rather than approve the route Joliet had endorsed and which eventually became the thoroughfare for that country; also to show that he regarded the horses possessed by the Pawnees as a factor to be used in the future development of the country. The Indians he refers to were all Pawnees, called by different names. He had already received a conditional patent for the vast region in which he was to labor at discovery, and probably regarded the horses possessed by the savages as one of the elements of his future prosperity. The Fort St. Louis referred to was near the village of the Kaskaskia Indians, on the Illinois river and was the place round which he hoped to gather the Indians of the West and South for the purpose of trade. Referring to this, he says in one of the Margry letters: "The arrival of the Ciscas and Chaouenon was followed by the return of the Illinois. The Tamaroas alone number three hundred cabins. Now all these nations come here to settle. The village of Matchinhoa, of three hundred fires, is thirty

leagues from the fort, to which it has also come and a part of the Emissourites and others, which together, form a village of two or three hundred fires. I have established their fields at four leagues from the fort."

Perhaps it is unnecessary for me to say that this scheme proved fruitless, and that the Missouris and other tribes soon returned to their own villages.

M. Bossu, a captain in the French Marines, spent several years in the Mississippi valley, and on his return to France, published at Paris in 1768, his travels in Louisiana, and has the following concerning the Missouris: "Baron Porneuf, who was governor of Fort Orleans, established in that nation, and who knows their genius perfectly well, has informed me that they were formerly very warlike and good, but that the French hunters had corrupted them by their bad conduct. They had made themselves contemptible by frauds in trade, they carried off Indian women and performed other irregularities which irritated the Missouris against them, and therefore, during M. de Bienville's government, they massacred the Sieur Dubois and the little garrison under his command, and as no soldier escaped, we have never been able to know who was right and who was wrong." At another place the author relates a long story, the substance of which is as follows: A trader from the French settlements deceived the Missouris by making them believe that powder would grow in their fields, thereby inducing them to purchase his stock and sow it for the purpose of raising a crop. The Missouris retaliated for this deceit by taking the goods of the next trader that visited them, without giving any furs in exchange. A subsequent trader turned the whole transaction to his own profit by bringing with him a keg of powdered charcoal and after inducing the chiefs to enter his hut for the purpose of trade, pretended to become crazy, and threatened to discharge his pistols into the keg of charcoal, which the Indians supposed to be powder, if the friends of the chiefs in the hut with him, did not bring beaver enough to pay for all the goods taken from the other trader. The Missouris supposing their chiefs to be in imminent danger, complied with the demand and brought in piles of beaver skins, when the crafty trader announced that he had recovered his senses. He then poured water on the charcoal to prevent a recurrence of the danger to his friends in case his senses left him again. By such schemes were the Indians defrauded by the French, who came among them for the purpose of trade.

The same author gives an instance of what he terms jugglery by one of the Missouris, as follows: "I will give you another account of the superstition of these people, and of the divine service they give to horrid animals. In 1756 there arrived a deputation of Indians at Fort Chartres, of the nation of Missouris. There was an old woman among them who passed for a magician. She wore around her naked body a living rattlesnake, whose bite is mortal if the remedy is not applied the moment after. This priestess of the devil spoke to the serpent, which seemed to understand what she said, 'I see,' said she, 'thou art weary of staying here, go then, return home, I shall find thee at my return.' The reptile immediately ran into the woods and took the road to the Missouris.

"If I had been inclined to be superstitious, I should have told you that I had seen the devil appear to these nations under the figure of a snake. Many missionaries have been willing to persuade us in their relations, that the devil appears to these people in order to be adored by them; but it is easy to see that there is nothing preternatural in it, the snake of the pretended witch did not go to her country, it was a mere juggle." Of the natural history of the country, the author remarks: "In the country of the Missouris there are magpies, only different from the European ones by their plumage, their black and white colors being shaded. The Indians make ornaments for their hair of them. On going towards the head of the river of the Missouris, you find all sorts of wild beasts. The wild goats and their young ones are very common at certain seasons. These animals are very lively and pretty. The French that have eaten of them assure me that the young venison is as good as the best mutton."

ARCHÆOLOGY.

WHO WERE THE MOUND-BUILDERS?

BY J. F. SNYDER, M. D.

"The conviction is daily gaining strength that the race of Indians found in occupancy of this country when it was discovered by the Europeans were the people, or the immediate descendants of the people, who built the mounds; and students of American Archæology now agree that mound-building was practiced by some of the tribes down to a comparatively recent date."

This opinion I recently expressed in a paper, published in the *Missouri Republican*, on "the death and resurrection of Black Hawk," and it embodies two propositions which I maintain to be true. It was quoted in the January number of the REVIEW with the following dissenting comment: "We doubt whether Professor Putnam, or any other first-class authority, will endorse this statement without considerable qualification."

In this criticism I am left in uncertainty as to the exact nature and amount of "qualification" the REVIEW regards as "considerable" or essential for the endorsement of my statement by first-class authorities; and also, as to precisely who, in the editor's estimation, besides the eminent gentleman named, constitute authorities of the first-class. Nevertheless, I will reiterate and specify, without fear of successful contradiction, that the conclusions to which I have arrived, as above quoted, are accepted with very slight, if any, qualifications, by such authorities as Professor Putnam and Lucien Carr, of the Peabody Museum of Ethnology; E. G. Squier, author of "Ancient Monuments of the Mississippi Valley, Etc."; Prof. Charles Rau, Curator of the Smithsonian Ethnological Department;

Col. C. C. Jones, Jr., author of "Antiquities of the Southern Indians, Etc."; Prof. Lewis H. Morgan, author of "Ancient Society, Etc."; Prof. N. H. Winchell; Prof. Joseph Jones, author of "Aboriginal Remains of Tennessee;" Dr. John J. R. Patrick, John P. Jones, Esq., and a host of other cultured students all over the country, who have expended years in diligent research and laborious investigation of American antiquities.

But we cannot rely upon mere opinions, however dogmatically asserted, in matters of natural science, to influence the convictions of thinking men. It is only reasonable that, in the issue joined, some of the deductions and facts upon which the views I have advanced are based, should be demanded and fairly considered. The proper presentation of all the evidence and a thorough discussion of the data forming that basis would require the space of a large volume and can only be epitomized in the limits allotted to this paper.

Though a mound of earth was erected on the battle-field of Waterloo, by order of the English government, only sixty-seven years ago, it is not seriously maintained by any one that the construction of an earthen mound necessarily requires a high degree of engineering skill or mathematical talent, or is in any view the achievement of special genius. On the contrary, earthen mounds are the product of only muscular effort, and were made by primitive people because they were the form of tumuli requiring the exercise of the least skill; the simplest and most easily constructed as well as the most enduring. Mound building, for the inhumation of the dead and in veneration of their memory, and for other rites of a sacred character, and in commemoration of important events, has been practiced, not exclusively by any one branch of the human family, nor only in any one era of the world's history, but alike by savage, barbarian and semi-civilized races, in all quarters of the globe, from the earliest to modern times. The early New Zealanders, the Celts, Gauls, Japanese, Scythians, Scandinavians, etc., heaped mounds over the bodies of their distinguished dead, and the ancient Greeks also erected mounds over the remains of their heroes slain in battle.

The mounds of the Mississippi basin are in no essential particular different from those seen on the plains of Europe or the steppes of Asia; and surely none of them, in conception or execution, are above the capacity of the Indians who entertained and fought De Soto, and whose descendants were subsequently studied by Adair, Bartram, Du Pratz and Charlevoix. The internal evidence of the mounds in this country, and the obvious uses of the numerous implements and ornaments of stone, shell, bone, etc., manufactured by their builders, and often found buried with their remains, imply that the mound-builder's methods of life, arts of subsistence, customs, habits, and mental characteristics were precisely identical with those of the Florida Indians at the date of their primal contact with Europeans and were the natural resultants of the necessities, passions and superstitions of a people occupying at best a middle plane of barbarism. In all the pre-historic remains of the Mississippi Valley not the slightest proof has been found to sustain the theory that it was at any time occupied by a race superior to the Mandans, Choctaws and Natchez; and there is not a sound reason for attributing the autho

ship of those remains to a distinct and now extinct people, when we know that those Indians were in possession of all of the arts, practices and superstitions claimed for that imaginary race. The builders of the mounds knew nothing of astronomy, mathematics or architecture. They had no knowledge of metals, having never even discovered the reduction of galena, the most readily fused of all ores. They lived in temporary huts of frail, perishable materials, and had not advanced to the art of constructing stationary abodes of clay or stone. Their wants had developed mechanical skill of no mean order, as is manifested by their coarse fabrics, woven of hemp and bark, their pottery, stone weapons, domestic implements, ornaments, etc. They had progressed in the arts of food production beyond reliance upon roots, mollusks and fruits to a rudimentary cultivation of the earth and the storing of provisions for future use. They made toys for the amusement of their children, and devices for playing games; but the chief pastime of the males, judging from the quantity and quality of the weapons and defences they left, was war and the chase. They believed in a future state of existence; buried their dead with tender care, and burned their captives without mercy. There is not the slighest foundation for the belief so frequently expressed, that they lived in an organized "Empire," or under any other form of political government; or that they possessed any description of written language or system of hieroglyphics; or had any formulated mode of worship; or entertained religious sentiments more elevated than the grossest superstitions.

This summary sketch accurately depicts the status of the mound-builders, and is a correct representation of the condition of the southern Indians when first discovered.

Comparative craniology has been invoked, by eminent ethnologists, to support the the theory of a pre-existent race superior to the Indians, with results by no means satisfactory. The mean cranial capacity of one people may be less or greater than that of another; but, so far no appreciable difference in mean internal capacity has been discovered between the crania of some of the Indians who built mounds and some who did not; and attempts to establish racial distinctions upon the shape of the skull by classing the one *Brachycephalic* (round skulls), and the other, *Dolicocephalic* (long skulls), is unscientific, arbitrary and not sustained by observed facts. Dr. Richard Owen remarked: "From an old and well-filled European grave yard may be selected specimens of *Klimocephalic*, *Conocephalic*, *Braehycephalic*, *Dolicophalic*, *Platycephalic*. *Leptocephalic* and other forms of crania equally worthy of penta or hexa-syllabic Greek epithets." This is true also of any large collection of crania of any race; and in a given number of skulls of ancient (mound-builder) and modern Indians, excepting such as have been artificially deformed, all the above types will probably be found. For it cannot be seriously contended that the heads of any people have all been for centuries cast in the same mould.

In the statement that mound-building had been practiced by some of the tribes down to a comparatively recent date it may be necessary to explain that the primal contact of the whites with the Indians of this continent; or, in other

words, the beginning of America's history, is accepted as "recent" compared to the vast antiquity claimed for the rise, grandeur and final extinction of the mound-builder's "Vanished Empire." With this "qualification" I will briefly cite, in corroboration of my statement, a few well-authenticated instances of comparatively recent mounds, or such as are known to have been erected subsequent to the intrusion of civilization and its arts.

Mr. Squier, in the second volume of "Contributions to Knowledge," of the Smithsonian Institution, describes mounds and earthworks extending from Canada to the Susquehanna, which were found to contain ornamented pottery, pipes, stone axes, hammers and discs and other stone-age implements identical in shape and material with similar specimens found by him in the Ohio mounds; and bone awls and needles together with iron axes, glass beads, cast copper hatchets, kettles of iron, brass and copper, and other articles of European manufacture. The building of these mounds he was forced to assign to the Iroquois within "comparatively recent dates;" though in every essential character they were exactly like the older mounds in central Ohio. In this (Cass) county, a few years ago, a mound, eight feet high by twenty-five feet in diameter, situated on a point of the Sangamon bluffs, was opened and found to contain the remains of one human skeleton walled around with rough stones, over which the earth had been heaped. With this skeleton were found a small earthenware cup, a few flint implements and an iron gun barrel. In another low mound six miles from this city, removed some years ago in opening a new road, the remains of several individuals were thrown out, together with stone axes, flint arrow-points, broken pottery, glass beads and brass rings. In the skeleton hand of one of the dead was a beautiful pipe, of polished serpentine, cut in the exact image of a frog. Col. C. C. Jones, Jr., found in a mound, not far from Savannah, with the bones of a skeleton at its base, an earthen pot, a few arrow-heads of flint, a stone celt, and the oak handle, with part of the blade of an old-fashioned sword. Bartram, as late as 1729, saw the Choctaws take from their tribal bone-house a large number of the remains of their dead in rude coffins, and after piling them up in a pyramid, heap over them a great mound of earth. Dr. Sternberg, of the U. S. Army, in a paper read in 1875, before the American Association for the Advancement of Science, describes his explorations of certain mounds near Pensacola, Florida, in which were found pottery, hematite paint rocks, flint weapons, perforated shell ornaments, blue-glass beads and pieces of iron. The old Winnebago chief, Winneshiek, said the mounds at Lanesboro, Minnesota, were erected by the Sioux, many generations before, in commemoration of a great victory the latter had achieved over his people. Tomochichi pointed out to Gov. Oglethorpe a large mound near Savannah, Georgia, which he said had been raised over the remains of the Yamicraw Chief who had, many years before, entertained a red-bearded white man, who had sailed up the Savannah River, in a large vessel, to the Yamicraw Bluffs.

The Natchez Indians when expelled from Louisiana, by the French, in 1728, retired to the neighborhood of Natchitoches and there built a mound of consider-

able size. Featherstonhaugh states that the Osages erected a mound over the corpse of one of their chiefs, called by the French, Jean Defoe, "enlarging it at intervals for a long period until it reached its present height." Catlin states that the Mandans erected mounds over their dead; and he gives the following account of the burial of Black Bird, a noted chief of the Omahas, about the year 1800, on the top of the Missouri bluffs, sixty miles from the present city of Omaha: "The O-ma-haw village was about sixty miles above this place; and this very noted chief, who had been on a visit to Washington City, in company with the Indian agent, died of the small-pox, near this spot on his return home; and, whilst dying, enjoined on his warriors who were about him, this singular request, which was literally complied with. He requested them to take his body down the river to this, his favorite haunt, and on the pinnacle of this towering bluff, to bury him on the back of his favorite war-horse, which was to be buried alive under him, from whence he could see, as he said, 'the Frenchmen passing up and down the river in their boats.' He owned, amongst many horses, a noble white steed that was led to the top of the grass-covered hill, and with great pomp and ceremony, in presence of the whole nation and several of the fur-traders and the Indian agent, he was placed astride of his horse's back, with his bow in his hand, and his shield and quiver slung—with his pipe and his medicine bag—with his supply of dried meat, and his tobacco-pouch replenished to last him through his journey to the 'beautiful hunting-grounds of the shades of his fathers'—with his flint and steel, and his tinder, to light his pipe by the way. The scalps that he had taken from his enemies' heads could be trophies for nobody else, and were hung to the bridle of his horse; he was in full dress and fully equipped, and on his head waved, to the last moment, his beautiful head-dress of war-eagles' plumes. In this plight, and the last funeral honors having been performed by the 'medicine-men,' every warrior of his band painted the palm and fingers of his right hand with vermilion, which was stamped, and perfectly impressed on the milk-white sides of his devoted horse. This all done, urfs were brought and placed around the feet and legs of the horse, and gradually laid up to his sides, and at last over the back and head of the unsuspecting animal; and last of all, over the head and even the eagle plumes of its valiant rider, where altogether have smouldered and remained undisturbed to the present day (1836). This mound, which is covered with green turf and spotted with wild flowers, with its cedar post in its center, can easily be seen at the distance of fifteen miles, by the *voyageur*, and forms for him a familiar and useful land-mark. Whilst visiting this mound in company with Major Sanford, on our way up the river, I discovered in a hole made in the mound, by a 'ground-hog' or some other animal, the skull of the horse; and by a little pains also came at the skull of the chief, which I carried to the river-side and secreted till my return in my canoe, when I took it in, and brought it with me to this place, where I now have it." I have quoted this interesting account at length because it fully authenticates the building of a sepulchral mound, by nomadic savages, so late as the beginning of the present century; and also because, the horse excepted, it no doub

graphically pictures the process of mound-inhumation practiced by their ancestors from time immemorial.

The one characteristic which, it is claimed, distinguishes the mortuary customs of the mound-builders from those of the nomadic Indians is the fact that the former never buried their dead beneath the surface of the ground, but invariably placed the remains of their deceased on the ground, or in very shallow excavations and heaped the earth over them; while the latter disposed of their deceased kinsmen by placing the dead bodies either on scaffolds, in graves beneath the earth's surface, or consumed them by burning. If this distinction is admitted, we cannot fail to recognize in the burial of Black Hawk, the great Sauk chief, in 1838, a vestige of the ancient custom of his ancestors, modified by the acquisition of European ideas and arts. The old chief when dead was arrayed in full dress, wrapped in fine new blankets, with all of his trophies, ornaments and sword at his sides; then laid on a plank and placed on the surface of the ground, with his feet in a shallow excavation about a foot in depth and his head raised a foot or more above the surface. A forked post was planted at his head and another at his feet, across which was placed a ridge pole supporting split boards, or "puncheons," leaning from the ground on either side of the corpse. The gable ends of this roof-like coffin were closed with rough boards, and the whole covered with earth and sod, forming a mound about four feet high. In this instance is presented all the elements of mound burial, only wanting the tribute of a small quantity of earth from each member of the tribe in passing by, or at their annual convocations, to make it, in course of time, a tumulus similar to the most ancient in our country. The disposition of the corpse in the large mound on the Scioto, six miles below Chillicothe, described on page 162 of "Ancient Monuments of the Mississippi Valley;" and of the remains at the base of the large mound at East St. Louis, removed in 1870 to make way for a railroad track; only differ from the inhumation of Black Hawk in having been enclosed with crib-work of cedar logs instead of the ridge-pole and split boards. There is also another suggestion offered by the grave of Black Hawk which may, not inappropriately, be mentioned here. It was surrounded, to guard it from the intrusion of men and animals, with strong pickets twelve feet high, planted in the ground, with earth thrown up against them to impart additional stability, in the manner that all Indians built stockades for military defense. Had this grave remained unmolested until the wooden pickets had disappeared by decay, the small mound covering the old chief would have appeared enclosed by an earthen ring, as was the case with the great mound at Marietta, and others of that class. In this may we not trace the origin and purpose of the mysterious ring embankments encircling some of the ancient mounds?

"During the progress of this investigation," remarks Col. C. C. Jones, in summing up the result of his researches among the antiquities of the Southern Indians, "it will be perceived that mound building, which seems to have fallen into disuse prior to the dawn of the historic period, was entirely abandoned very shortly after intercourse was established between Europeans and red men. *

* * In a word, we do not concur in the opinion, so often expressed, that the mound-builders were a race distinct from and superior in art, government, and religion, to the Southern Indians of the fifteenth and sixteenth centuries." In a very able paper on the "Ancient Copper Mines of Isle Royale," by Prof. N. H. Winchell, in the *Popular Science Monthly* of last September, he forcibly says: "If we inquire further what relation the mound-builders bore to the Aborigines found here by Columbus, we shall be compelled to admit, from the evidence, that the Aborigines themselves were the mound-builders and ancient miners. * * * It is poor philosophy and poor science that resorts to hypothetical causes when those already known are sufficient to produce the known effect. The Indian is a known adequate cause. The assignment of the mounds to any other dynasty was born of that common reverence for the past and for the unexplainable, which not only unconsciously augments the actual, but revolts at the reduction of their works to the level of the red man."

To this sentiment of veneration for the past and common tendency to exaggerate the marvelous we owe the entire fabric of an imaginary semi-civilized race and mythical empire, gorgeous in semi-barbaric splendor and fascinating in wild interest as an oriental tale. It has, however, had its day and is rapidly fading away before the iconoclasm of research and common sense.

VIRGINIA, CASS CO., ILL., January 23, 1882.

THE MOUND-BUILDERS AND THE AZTECS.

Writing to the Chicago *Times* from New Mexico, Mr. S. B. Evans states that on the highest point of the great Potrero de las Vacas are some of the most remarkable prehistoric relics that have been discovered in New Mexico, being no less than the gods sculptured in stone that were worshiped by the ancients. These are statues of mountain lions, carved from a volcanic rock *in situ* that forms the cap of the potrero. The images are inclosed in a rude and almost circular stone wall, in a space fifty feet in circumference, three feet in height, with an entrance projected eighteen feet toward the southeast, three feet wide. The lions face directly toward the east, are two in number, separated by a space of twelve inches, and are each six feet in length, and represent a puma or mountain lion in the act of crouching for a spring. The heads of these statues are almost entirely destroyed, showing plainly the marks of the pious hammer that sought their overthrow. The legs, body, and tails of the animals are better preserved, and constitute the remains of the most remarkable stone images set up for pagan worship in the territory of the United States. To these gods the Cochiti Indians of the present day pay homage.

In the courtyard of the national museum in Mexico are carved images, in stone, of similar animals. Some of them are well preserved, while others bear the marks of Spanish defacement. The mountain lion was a sacred animal among

the Mexicans, as well as with the ancient and present dwellers in the mountains of Cochiti.

Opposite to and north of the potrero of the lions, in the face of a cliff and fronting a deep cañon, is a series of cliff dwellings, hewn out of the rock, in which centuries ago men made their habitations, lived, and died. All the cliff buildings which Mr. Evans has examined, face toward the south. This may be accidental. They all conform to a general style of construction. This is the result of purpose. They are superior in workmanship to the cave dwellings of Europe, and inferior to the efforts of the town-builders of New Mexico and Arizona. They are not the work of nomads, who do not stop long enough, nor do they have the disposition to hew out for themselves habitations in the rocks, but may be identified with the people who emigrated from the seven cave cities of Aztlan and found refuge in Mexico, one thousand years ago.

The antiquities of New Mexico, Colorado, and Arizona are distinct from those of any other portion of the United States, and the forms peculiar to the two last named are found in New Mexico. The object of the explorations which Mr. Evans is making, was primarily and prominently to throw light on the origin of the mysterious mound-builders, and to find, if it exists, the analogy between their works and those of the pyramid-builders in the valley of Mexico. If that analogy were established it was believed that one important step would be gained in the solution of the problem.

Beginning in Minnesota, he has by personal survey traced the mound builders to the Gulf, and found an unbroken chain of their curious works down the valley of the Mississippi, into colonies on the principal tributaries traversing the States that border on the great stream. Mounds were found along the entire route and on the shores of the Gulf. Crossing into Mexico, the chain dropped in the sea at Galveston, was recovered near Vera Cruz. On the plain of Cholula is a mound, that, if transferred to Cahokia, would fit the landscape, and appear in keeping with the general plan of the works. On the other hand, if the great mound of Cahokia were brought in presence of Popocatapetl, it would not be abashed, but be a fit companion for the pyramid. The pyramids of the sun and moon at Teotlihuacon would be mounds in Virginia and Ohio, and the great mounds of Grove Creek and Seltzertown might embellish the ancient "City of the Gods." Excavations were made in Mexican mounds as they were made in the United States, and, substantially, the results were the same—tombs in some mounds, altars in others, and nothing in a few. Pottery was found with the lines of ornamentation the same as that discovered in Arkansas; heads of idols the counterpart of those found in Tennessee; children's toys from each, that might have been produced from the same mould, and skulls from the tombs of San Juan with the same peculiar flattening of the occipital region that distinguishes the skulls of the mound-builders wherever they are found in the United States. The presence of an intrusive race was early detected, and the comment made that it was impossible for the Aztecs to have been the builders of the pyramids or any of the works of antiquity in that region. This, Mr. Evans

thinks he has demonstrated since, and produced absolute proofs through investigations made in New Mexico. The Aztecs were not then, or at any time, a mound-building race, and there are no mounds in New Mexico from whence they spring.

Mr. Evans concludes: "It will now be seen how necessary it was to investigate the antiquities of this territory in order to throw light on those of Mexico and the States. With the evidence all in, let us recapitulate and see what we have gained. Investigations have established the following as facts:

1. "The mounds of the United States were made by the same race that built the mounds of Mexico. Proven by close resemblance between the works; by implements used in common; similar manner of burial, and skulls from the tombs of each locality.

2. "The mounds of Mexico antedate Aztec occupation. Proven by records that the Aztecs did not enter the valley until the close of the thirteenth century; by investigation that the mounds contain skulls that are not Aztec; that they contain specimens of the plastic art that could not have come from the hand of an Aztec.

3. "The Aztecs were not a mound-building race. Proven by investigation in New Mexico, disclosing the fact that there are no temple, sacrificial, or burial mounds in the land from which they come; that they build no mounds here, and built none in Mexico from the time the Spaniards occupied the country in 1520 until the present, and it was a physical impossibility, even though they had the knowledge, to have erected all the mounds and pyramids in Mexico during the space of time that elapsed from their entry into the valley until its occupation by the Spaniards."—*Scientific American.*

GEOLOGY.

THE CHERT ROCKS OF SUB-CARBONIFEROUS KANSAS.

BY ERASMUS HAWORTH, B. S.

The Keokuk group of the sub-carboniferous in Southeastern Kansas, presents many interesting phenomena. According to Prof. Mudge, the stream known as Spring River marks the northwestern boundary of this group. This, I think, is not exactly correct. In some places on the west side of the river, the formations appear to be the same as those on the east. In this Keokuk group occur the lead and zinc deposits of Short Creek and, farther east in Missouri, those of Joplin City, Oronogo, Webb City and other places of less notoriety.

The occurrence of lead and zinc ores in this vicinity has been so frequently discussed, that perhaps nothing new could be said on the subject. But the pecu-

liar occurrence of the chert beds, which are everywhere quite common, is almost as interesting to the scientist, although they will never call together thousands of people, or transform the poor disheartened prospector into a millionaire.

The chert formations occur at different depths, as deep as shafts have been sunk, alternating with limestone. In some places there seems to be but little regularity to the deposits, while in others they lie one above the other, the irregularities of the one closely fitting those of the other. A high bluff on the right bank of Shawnee creek, about half a mile above where it enters Spring River, affords a view of these alternations. This bluff is from 80 to 100 feet high, and is very abrupt, making an angle of about 75° with the horizontal. Here the layers of limestone and chert alternate with great regularity, the layers of each varying from only a few inches in thickness to as much as three feet.

In some places there seems to be no opening or crevice between the two kinds of rock, but they are firmly held together so that when the rocks are broken in pieces, fragments may be obtained, consisting partly of limestone and partly of flint. Cart loads of such specimens could be picked up along the foot of the bluff.

On the left bank of Spring River at the little town of Lowell, is another high bluff, which affords excellent opportunities for studying the formations. Here also are limestone and chert formations alternating with each other. The layers of chert are not continuous as they are at Shawnee Creek bluff. A layer at one place may be six inches thick and at a short distance in either direction entirely disappear, thus presenting somewhat the shape of a very large thin disc.

Throughout this whole region may be found cherty concretions, having in general the shape of a prolate spheroid, the major axis of which is twice that of its minor. These differ greatly in size. Some of them are so small that the major axis does not exceed three inches, while in others it is fully twenty inches long. These concretions are generally solid throughout; occasionally, however, one is found with a small, narrow cavity at the centre, parallel with its major axis. As far as I have observed, these cavities are never lined with crystals. A transverse section of the concretions shows concentric circular bands, intimating that their formation was symmetrical with reference to their major axis. The miners call them "mineral eggs." I have noticed them in greatest abundance on the west side of the river. On the right bank of Shawnee creek, half a mile above the high bluff before referred to, in connection with other cherty rocks they occur fully fifteen feet above the highest limestone horizon. (It might properly be stated that north and west of the sub-carboniferous is a great sandstone formation, the limits of which I cannot give, but I think it is bounded on the west by Neosho River and extends some thirty miles north). In a few instances, these concretions have been found imbedded in limestone which fit closely around them. These chert rocks are filled with fossils, which are so numerous that it is doubtful whether, from the shells alone, a limestone could be distinguished from a chert rock. In fact, almost every fragment that is picked up, is filled with fossils, whether it comes from the hill side or from the gravel

beds of the streams. Crinoids seem to be the most abundant, but many other types are represented. The shells of the crinoids are rarely present, but the cavities from which they have been removed so perfectly represent their outlines that their forms are plainly shown. There is, however, quite frequently a central stem of silica corresponding to the central cavity of the crinoid stem. They have been so numerous that it is easy to find blocks of chert that will not weigh more than half as much as an equivalent volume of solid chert. Specimens are sometimes found which show that a portion of the rock was formed without including shells, while the other portion of the same specimen was literally filled with them.

In some places the chert presents quite a tufaceous appearance. This is best represented at the Short Creek mines, although it is by no means confined to that locality, many similar specimens having been found on the west side of the river. At Short Creek hundreds of tons of this partly decomposed chert have been lifted from the mines. In many cases the outlines of the fossils are still easily detected. Also it is not uncommon to find inclosed crystals of sphalerite (zinc blende), or cavities from which such crystals have been dissolved. It was an easy matter to select a series of specimens, showing all the variations, from those in which the crystals were almost perfect to those from which they had been entirely removed.

In such a series, it is to be noted that the decomposition of the rock itself corresponds almost exactly with that of the sphalerite crystals; that is, the rocks which contain the most perfect crystals are the least decomposed, while those from which the crystals have been entirely removed, have suffered the greatest decomposition.

Another peculiarity of the chert is the fact that it has innumerable fractures running in every direction. In some places they are quite a distance apart, in others they are very close together. In some places great masses of it seem to have been broken into millions of fragments without any of them being removed; in other places the angular fragments seem to have been partially removed and subsequently formed into conglomerates by the cementing action of calcite, dolomite, iron oxide or zinc blende.

For two reasons I have thus detailed facts which can be observed by all. First, it is thought that Southeastern Kansas is not only the most intricate, geologically, but also the most interesting of any part of the State. Second, the facts mentioned may have a bearing on theoretical geology.

Three hypotheses have been offered to explain these phenomena. First, all of the rocks except the conglomerates were originally limestone. In the course of time waters charged with silica, or a silicate, metamorphosed portions of the limestone, leaving them in their present condition. Previous to this action, cavities had been worn in the limestone in which the silica-laden waters deposited silica, forming the concretions. In some places the limestone has been subsequently removed, leaving the concretions free; in other places they have been

held *in situ*. Second, the silica was present from the first formation of the rocks, having been collected by *Polycystines*, *Diatoms*, the spicules of *Sponges*, etc. Third, the silica was present from the first formation of the rocks, but was deposited by physical and chemical means, rather than by the intervention of life.

The first hypothesis is objectionable because it seems inadequate. It is difficult to conceive of conditions under which great strata of limestone could be completely silicified without altering those in direct contact with them. It is true, the purest limestone in this locality contains silica; some specimens may be found containing a large per cent. of it, but there is no trouble whatever in distinguishing the limestone from the chert. In other words, so far as has been observed, there is positively no gradation of the one into the other, as would necessarily be the case had the above mentioned metamorphic action taken place. The occurrence of the concretions and the chert so far above the limestone horizon, would be impossible by this theory, unless we conclude that here the change from the limestone to the chert was complete. But it is hardly possible that the transformation act would have been so complete here and so incomplete in other places. Again, the condition of the fossil crinoids has a testimony of value. Had they been imbedded in limestone, it is hardly probable that the limestone itself would have been completely changed to the most compact chert without the same action affecting them sensibly. If we assume, however, that the body of the rock was chert when it was first formed, we can easily see how the central cavity of the crinoid stem would be filled with silica, and how the body of the stem itself, long after the rock had become a compact mass of flint, could be removed by the solvent action of water, the most solid rock being penetrated by water. The fact that in the same mass of chert one portion has been filled with crinoids, and the other portion has contained none, may also throw light upon the subject. It is quite possible for a mass of silicic acid, were it present in sufficient quantity, to settle to the bottom of the water in which it was suspended, completely cover up and enclose within its mass all the shells which were present, so that the lower portion of the rock thus formed would be filled with shells, while the upper portion would be free from them. If, then, there is any action between silicic acid and calcium carbonate, some of the shells would be silicified. The facts observed exactly correspond to such an hypothesis.

It is well known that waters charged with silicic acid do affect limestone and calcareous shells. Prof. Patrick* of Kansas State University, has shown that such an action has taken place at the Great Spirit Spring, near Cawker City, Kan. Church† had occasion to investigate this subject in his researches with reference to the origin of beekite, a peculiarly mineralized fossil quite common in some parts of England, He passed water containing carbonic oxide and silicic acid in solution, through a piece of coral fitted into the neck of a funnel. The porosity of the coral permitted the water slowly to pass through. Almost the whole of the silica was deposited on the coral in a jelly like mass, while a cor-

*Trans. Kan. Aca'd. Sci. Vol. 7, P. 22.
†L. E. & D. Phil. Mag. (4) Vol. 23, P. 95.

responding amount of calcium carbonate was removed. Dr. T. Sterry Hunt* has held that the numerous silicified shells have thus been changed before they were enclosed in the limestone which surrounds them. He describes shells which are only partly silicified, the central portion being unchanged.

The second hypothesis mentioned is understood to be the generally accepted view. It may fairly be represented by quoting from pages 615 and 691 of Dana's Manual of Geology, 1876: "The silica in most siliceous petrifactions, has come from siliceous organisms associated with the fossil in the original deposit;" and: "The geological effects of silica in *cold* solutions appear to be of only infinitesimal importance." There can be no doubt that the spicules of *Sponges* and the shells of *Diatoms* and *Polycystines*, have contributed largely to the silica of the earth's crust. The flint nodules of chalk seem to be almost entirely composed of them. Throughout the whole stratified crust of the earth, we find sandstone and chert formations in great abundance. The sub-carboniferous of Missouri, Tennessee, Kentucky, Iowa, Illinois, Indiana, and in general wherever it occurs, presents phenomena similar in many respects to those observed in Kansas. Fossils imbedded in chert are common to all the above mentioned States. In fully one-third of the State of Tennessee the sub-carboniferous is exposed, the lower portion of which has been named the "Siliceous Group."‡ Portions of the sandstones are fragmental rocks, which may be traced to granitic and other forms of siliceous rocks. But we can go no farther. We cannot say how the silica came in those rocks, but we have every reason to believe that life had no part in their formation. Other portions of sandstone show, from the perfect crystalline form of their grains, that they are *not fragmental*, but that the silica has been deposited in some manner that favored crystallization, so that organisms are shut out from these. Daubree§ has shown that by the mechanical decomposition of ancient rocks, the proportion of silica left in the form of sand, would be entirely too small for the formation of all the great beds of sandstone; also that in different parts of France a large per cent. of the sandstone is composed of crystallized grains. Mr. J. Brainard, at the meeting of the American Association for the Advancement of Science in 1860, called attention to certain sandstone in Ohio of crystalline origin.

It is well known that natural waters frequently hold silica in solution. Deville‖ has said that silica was found in *all* the natural waters which he has examined. M. Ebelman ¶, by a careful and exhaustive analysis of basaltic and similar rocks in different degrees of decomposition, has found that the amount of silica rendered soluble by decomposition is as great, in some instances, as 57 per per cent. of the original amount. He compared the alumina with the silica before and after decomposition, and found that in some specimens in which for

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*Canadian Naturalist, New Series, Vol. 1, P. 46.

‡Safford's Geol. Sur. of Ten.

§Annals Des Mines (5) Vol. 12, P. 535.

‖Annals de Chemie et de Physique. Vol. 23, p. 33.

¶Annals des Mines (4). Vol. 6, p. 31.

100 parts of alumina there were 347.5 parts of silica before decomposition, the proportion in the resulting clay is only 100 : 118.3.

When we consider the vast amount of silica that has thus been carried to the sea, we are forced to conclude that it must have been deposited by some other means than that of life. The amount is too great to be referred to so small a number of microscopic organisms. Even if we did not have the positive evidence in the crystallized grains of sandstone, we could draw such a conclusion; but when we have this we may reasonably conclude that *other* portions have also been deposited without such assistance. The question then arises, what is there to indicate that the greater part of the silica in the *petrified* remains of organisms is derived from animals and plants that secrete siliceous matter? In all cases where true petrifaction has taken place the silica must have been in solution, and if the spicules of Sponges, etc., are once dissolved, the silica simply takes its place with other portions that are held in solution and can no longer be looked upon as of organic origin. The extraordinary occurrence of chert beds in the sub-carboniferous may be due to the fact that it succeeded an age when the conditions were most favorable for the rapid decomposition of ancient crystalline rocks. The air was probably much richer in carbonic oxide than at present, and there was a larger surface of metamorphic and crystalline rocks exposed than has been at any subsequent time; because, as the decomposition continued, portions of the surface once exposed would be protected from the atmosphere by the clays and soils formed, and the new formations that subsequently emerged contain but few rocks that would yield silica by the action of decomposing agents. There was the great V-shaped ridge on the north which extended as far south as Pennsylvania and also included a large portion of Ohio. A ridge extended down the Alleghenies as far as South Carolina. There was also a large tract in Missouri, including the greater portion of the Ozark Mountains. The great central basin of the Mississippi Valley was thus almost entirely surrounded by hills of decomposing rocks, the silica of which was being poured into its waters. Everything was thus favorable for a *maximum* formation of siliceous strata. If the decomposition of these ancient rocks was as rapid as we have reason to suspect, the proportion of silica which the ocean waters contained was much greater than at the present time. Graham* has shown that when pure silica is held in solution, $\frac{1}{10000}$ part of an alkali or alkali earth carbonate precipitates it. At the present time the greater portion of silica is held in solution by an alkali that is an alkaline silicate. But this is not necessarily so. In the article above referred to, Ebelman has shown that an alkali is not essential. The following are his words: "The researches which I have described have shown that the silicates without alkalies are decomposed as easily as the feldspathic species, sometimes even before them, and that the removal of the silica is, in certain cases, more complete than from [in] kaoline. The separation of silica may, therefore, be entirely independent of alkalies."

* Philosophical Magazine (4). Vol. 23, p. 296.

It seems but reasonable, then, that large portions of silica were precipitated as gelatinous silicic acid which gradually settled to the bottom and formed great chert layers. There would not be pure silica unless the waters were free from impurities, neither would the limestone formed be free from flint unless the waters were periodically *entirely* free from silica. Let us recall the condition in which these rocks are now found in southeastern Kansas. The regular stratification in places alternating with limestone which was forming at the same geological time, just as it should be. Also the presence of fossils would be expected, some of them being silicified, others resisting this action, to be subsequently removed by waters charged with carbonic oxide.

The concretionary formations with their banded structure might also have been expected; and finally the irregular deposits which have been called "disc shaped" would certainly be formed where there was not enough silica to form continuous layers. As far as observed, everything seems to be just as one would expect. The writer looks upon the peculiar formations described as evidences which may be added to that of the sandstones composed of crystallized grains. The amount of silica included in the chert and sandstone beds of different eras is so great that anything short of direct precipitation and crystallization from saturated solutions, seems to him intirely inadequate as a cause.

The tufaceous appearance of some of the rocks is evidently due to the solvent power of water. Dr. Schmidt, of St. Louis,* thinks that these are of much more recent formation than the others; that the limestone was first dissolved and the cavities filled with porous chert. This view is inconsistent with the occurrence of fossils in these rocks. If the limestone had been dissolved out, the fossils would have been destroyed, so that the subsequent formations in the cavities thus produced would have been entirely barren of fossils. They also contain zinc crystals as occasionally do the undecomposed rocks, which would further indicate that they were of the same age.

What already has been said will show that these rocks cannot be of volcanic origin, as has been held by Prof. Hay, of Chetopa, Kansas. The occurrence of fossils alone is sufficient to disprove this theory, but the additional evidence of the enclosed crystals place it beyond all doubt. If we consider the great range of temperature between the fusing points of zinc sulphide and silica, it is seen at once that the idea of the two having cooled from a molten mass is entirely unreasonable. The fractures in the chert beds remain unexplained. Dr. Schmidt, as above referred to, attributes them to the contraction caused by the dolomitization of the limestone and the dislocations caused by the dissolving out of the limestone in places. This view is objectionable for two reasons. First, the decline of the old theory that pure limestone is dolomitized on a grand scale. With our present knowledge of the chemical properties of the salts of calcium and magnesium it seems much more reasonable that the magnesium now present in the great beds of limestone in the Mississippi Valley was enclosed in their formation. Second, if the old theory be true, the assigned cause is entirely insufficient.

* Trans. St. Louis Acad. Sci., Vol. 3, No. 2 p. 246.

The contraction of the limestone, however great, could not cause those fine fractures so common in many places. Neither could it fracture the rocks at so great a distance from the limestone as has been done. I have often seen rocks heated to a moderately high temperature and plunged into water. The sudden cooling would cause them to crack in every direction, but their fractures would be no more irregular or complicated than those of the chert rocks above alluded to. The idea of their having been heated is entirely untenable, however: the fossils in the limestones would contradict such views. They remain thus far unexplained.

THE FORMATION OF COAL.

All attempts to explain satisfactorily the formation of coal have thus far proved unsuccessful, though it is generally understood that it is the product of the decomposition of vegetable matter. Just how that decomposition has been brought about chemically is a matter which chemists have not as yet been able to solve. The principal difficulty has been that it has been impossible to obtain a clear insight into the chemical constitution of coal. It has been thought hitherto, and this is still the popular belief, that coal is in the main pure carbon, mixed with varying quantities of bituminous substances. It has been generally believed, that, as the product of the distillation of coal is principally carbon, it would be safe to conclude that free carbon actually does exist in coal. The fact that sugar, starch, etc., under similar circumstances, leave a residuum consisting of carbon, has never been considered a proof that that element existed in these bodies in a free state. It is well known that coals which may have the same percentage of carbon, hydrogen and oxygen do not by any means, in coking, yield the same products of distillation, and we have a complete analogy for this in the behavior of cellulose and starch when subjected to distillation. Evidence points to the conclusion that coal is a mixture of many and complex compounds; and the difficulty, amounting to almost an impossibility, of separating these compounds, has much to do in rendering a chemical solution of the questions involved in the formation of coal a very arduous task. The production of coal by artificial means is met by great obstacles, among which the absence of all knowledge concerning the conditions under which that process actually took place is the principal one. The question whether the vegetable matter to which our coal veins owe their origin was amassed by drifting or was carbonized *in situ*, has been much debated, and there has been much discussion on the point whether it was obtained from water or from land plants.

Dr. Muck, of Bochum, in a recent work, takes up the theory that algæ have mainly contributed to the formation of coal. It is urged that the remains of marine plants are rarely found in coal veins, and that shells, etc., are not often met with. Dr. Muck calls attention to the fact that marine plants decompose easily and completely, losing their form entirely; and that the disappearance of

the calcareous remains of molluscs is readily explained by the formation of large quantities of carbonic acid gas during the process of carbonization. In accepting the marine origin of coal it is not necessary to resort to the assumption of immense pressure and high temperatures to explain decomposition and the total destruction of the structure of the original substance. Dr. Muck combats Frémy's bog theory at length. His views are well supported by recent investigations made by Herr P. F. Reinsch, who has examined 1,200 sections of coal, coming to the conclusion that that mineral substance has not been formed by the alteration of accumulated land plants. Herr Reinsch claims to have discovered that coal consists of microscopical organic forms of a low order of protoplasm; and though he carefully examined the cells and other remains of plants of a higher order, he computed that they have contributed only a fraction of the matter of the coal veins, however numerous they may be in some instances.—*Journal of Applied Chemistry.*

GEOGRAPHY.

(*Translated from l' Exploration, December* 15, 1881, *by E. L. Berthoud.*)

ASIA.

FROM THE FRENCH OF SEVERTSOF.

THE PAMIR OR ROOF OF THE WORLD.—Mr. Severtsof, an eminent Russian explorer, has ascertained that the "Pamir" is not a plateau in the absolute sense of that word.

It is traversed by rivers flowing at an altitude of 14,000 feet in valleys nowhere exceeding thirteen miles in width. This same peculiarity is also noticed in the Tien Chan Mountains, and in Thibet, where we find narrow valleys or enormous elevations.

In the "Pamir" there is no table land where we find mountains 6,000, or 7,000 feet high above the level of these valleys. The orographic system of the Pamir includes numerous peaks which attain an elevation of 19,000 feet, and three groups of mountains which reach an elevation of 25,000 feet above sea level.

THE RUSSIANS IN KASHGAR.—A commercial caravan conducted by Mr. Dalgleish, a Russian merchant, reached Yarkand on the 8th of September, 1881.

The caravan has been cordially received by the Governor of Kashgar, who gave to Mr. Dalgleish authority to reside in the city and sell his merchanise in all the province of Kashgar.

AFRICA.

Explorations of the Zambesi.——Mr. Guyot, a French explorer, has been exploring the Zambesi and its affluents. September 10, 1881, he reached Tetts, a Portuguese settlement.

His exploration has been in part on the river Muareze, an affluent of the left bank of the Zambesi. This river has appeared on the map of St. Jvao Montero de Foureca Vatz, as the Uamiteuze, a name unknown to the natives. He finds on the Muareze a carboniferous formation with its schiests and its sandstones and huge masses of diorite, of such magnitude that the shores and bluffs were wholly composed of it.

On leaving the Zambesi he found a number of villages where he obtained provisions and hospitable treatment by distributing some cotton cloth.

The strata of coal found in the bed of the Muareze are thin sheets intercalated in strata of schists, which alter its quality very perceptibly.

At twelve miles distance from the Zambesi roads are difficult, and safety very uncertainty. The whole country is infested by Bonja, who are brigands; Mr. Guyot escaped attack solely on account of his escort of fifty Sepoys.

The health of the expedition is excellent, and some of the party have started for Manico.

We have lately announced the happy return from Timbo, in western Africa, of Mr. V. Gaboriand, who was intrusted by Mr. Aime Olivier with the mission of obtaining from the Almany of Foota Djalloo, a confirmation of the treaty of friendship and the concession of a railway, already accepted and signed between Mr. Aime Olivier and the Almany Javery, the predecessor of Ahmadon the present ruler.

The Commercial Geographical Society of Paris has received on this subject new particulars as follows: Mr. Gaboriand brought back with him a copy written in Arabic, signed by Ahmadon, countersigned by his heir and properly certified to by their interpreter, of a treaty signed on the 10th day of July, at Timbo, between Mr. Gaboriand and the above named chief.

The terms of this treaty are as follows: Almany Ahmadon authorizes the construction of a railway, which is to end on the west coast, and concedes to the R. R. Co. the necessary lands for its construction.

He also agrees to furnish all the laborers necessary for its construction, and to protect the construction and maintenance of this enterprise; granting also to Mr. A. Olivier the right to establish in his government, free from tax or any assessment, factories or commercial trading houses.

"All aboard for Timbuctoo," will soon be as well known as any other railway tour: for the construction of this road to Timbo from the Senegal is a vast step forward into Central Africa.

RUSSIAN EXPEDITION TO THE BAY OF OBI.

Colonel Veninkoff has written some details on the Russian Expedition sent in the spring of 1881, under the direction of Colonel Moisseef, to the Bay of Obi.

The explorers have followed the eastern shore of the Bay between the 67° and 72° latitude, and by their astronomical observations have demonstrated the fact that on our maps we must move the coast from 20 to 25 kilometers more to the west. On the other hand the Bay of Obi being reduced in width, the peninsula between the Obi and the Taze is largely increased in width.

At the mouth of the Lena a meteorological and magnetic station is to be established. As we have before stated, the expedition charged with this work has just started from St. Petersburg. The Russian Geographical Society which has taken the initiative in concert with all other scientific institutions that are instructed with the realization of the project of Comte Wilezek.

The observer selected for this station is a young man, Mr. Yurgens; who to reach his destination, will have to travel 3,000 kilometers in a sleigh, then 3,000 kilometers in a bark or in canoes.

He is to return at the end of one year. We will thus have an uninterrupted set of observations regularly taken and maintained in a circumpolar station, which is something of which there is almost a total want.

OPTICS.

"CONTINUOUS IMAGES OF LIGHTNING."

BY PROFESSOR FRANCIS E. NIPHER.

The phenomena described by Mr. Blair in the February number of the REVIEW is one which can be reproduced at any time by looking at any bright object, like a gas flame or even a candle. The explanation is correctly referred by the editor to a residual effect upon the retina.

If a gas flame is observed by fixing the eye steadily for a few seconds upon some point *near* the flame, and if the eye is then closed or turned quickly to a darker part of the room, an after image of the flame will be observed. This effect lasts but a short time and requires careful observation in order to see it unless the object viewed be bright. Nevertheless, the part of the retina upon which the image of the flame was formed is still in a different condition from the rest of the retina, and this may be seen by turning toward the flame again, so that the light will again enter the eye, at the same time opening and closing the eyes rapidly. The after image will again come out in a most vivid manner, and can be seen for several minutes. This reproduces the same conditions under which Mr.

Blair observed the after images of lightning flashes. This experiment can be made in a most striking manner by means of the sun. Observe for a few seconds some point on the sky, say ten to thirty degrees from the sun, then move the eyes quickly to some other point, again holding the eyes still for a few seconds and repeat the operation for ten or fifteen points around the sun. Then turn partially around, looking at the blue sky or at a bright cloud, and you will observe the after images as usually described. But if you open and close the eyes rapidly, the after images come out with astonishing distinctness. The field of vision will be filled with images of the sun connected by lines which indicate the paths traced by the solar image in passing from one position to the other upon the retina. The color of the images, also, is very marked, and goes through various changes which depend upon the nature and intensity of the light, upon the brightness of the sky which is observed, and probably upon the observer. These images appear to have a motion in the field of view, but this is merely the motion of the eyes, and the experiment will serve to indicate to the observer how difficult it is to keep the eyes still.

A partial explanation of the phenomena it is not difficult to give. If any brilliant color, (say a bright cloud through a red glass, or a red paper well illuminated by diffuse light,) be observed for some time, the sensation of color become gradually feebler. Ordinarily this is not noticed, but by closing one eye and observing with the other it will be brought out very distinctly if the eyes are after a time alternately opened and closed. The red will appear much deeper to the eye which has not been fatigued for red. To an eye fatigued for red a white paper would appear as though red had been stricken out, *i. e.*, it would appear greenish while a green color would appear more intense. The same holds for the other colors. The part of the retina upon which the image of the sun fell was fatigued for *all* colors, and hence the after image on a bright ground appears dark at first The fatigued part of the retina gradually recovers its sensitiveness, and appear to recover more quickly for some colors than for others ; the color of the after image at any moment being thus the combination of the colors for which that part of the retina has at the moment become sensitive.

Two works recently published in the "International Scientific Series," will be found exceedingly interesting and instructive in the study of such phenomena *viz.*, "Modern Chromatics," by Rood, and "Sight," by Le Conte. Both work are admirable, not only in describing many experiments which any one can mak for himself, but in presenting clearly and in a simple manner the general princi ples which enable one to explain similar phenomena. As the eye is the on optical instrument which we all possess, it is certainly natural that we should a feel an interest in the study of its action and its peculiarities.

CONCHOLOGY.

NOTES ON DISTRIBUTION OF SHELLS.—NO. II.

BY F. A. SAMPSON, FT. WORTH, TEXAS.

The present mild winter doubtless gave a better opportunity for finding liv-ıg shells at Ft. Worth, than would often occur at New Year, but with butter-es and moths flying, one would naturally expect to find shells still crawling or ghtly covered. The country around is generally prairie, but along the Trinity ver and other streams, there is more or less bottom land of post-pliocene forma-on, and bordering these streams are bluffs more or less rocky, and in places out one hundred feet in height, the rock exposures and the prairies all being of e cretaceous period.

Of the shells found by me around the town, and on trips in two directions out ten miles each, I make the following notes:

1 *Mesodon roëmeri* Pfr. Found at all stations near timber, both on the uffs and in the bottoms in considerable numbers, and bunched together as if r the purpose of imparting warmth to each other. Under one small log in the inity bottom I obtained over fifty mature live specimens. I could detect no fference in those found on the bluffs from those on the lower grounds, but the ells all differ considerably from the same species at New Braunfels, Texas, being ger in size, of deeper color, and uniformly open umbilicus. I found a single bino.

2. *Polygyra texasiana*, Moricand, was quite plenty in places in the river ttom, under stones, logs and in the ground where brush and leaves were lying. nney in his Land Shells of North America, gives the size of this species as 10 n., and says that there is a larger size with a brown band above the periphery. ie specimens here, however, are from 8 to 10 mm. and all have the brown band ore or less distinct. Through the shell the animal shows irregular black spots, last whirl having a line of them, sometimes continuous, running diagonally ough nearly one revolution. In some the spots are quite large and in others all. The eye peduncles are deep black, and from their bases are two bands of ck down the neck and body, the remaining parts being a uniform light color.

3. *Polygyra mooreana*, W. G. Binney, was not plenty, principally on the bluffs. ss than half the shells were white, but those of horn color appeared to differ no respect except in the color of the shell. The spots showing through the ll were not so large or so black as in the last species. The head, neck and dy were a uniform dark brown, and the eye peduncles still darker. Al

specimens were uniformly of five and one-half whirls, while *P. texasiana* varie
from five to five and one-half.

4. Polygyra dorfenilliana, Lea. But a single specimen was found. A
Denison it is common, and the other two here found of the same sub-genus ar
not found there.

5. Helicina orbiculata, Say, was apparently as much at home on the bluffs a
on the bottoms. From one to three inches in the ground under leaves and brush
and in some cases under logs and stones, they were found hibernating. Th
shells were larger than those from Denison or Houston, but there were fewe
colored shells than at the former place.

6. Bulimulus alternatus, Say, or that variety which has been described as
separate species under the name of B. Schiedeanus, Pfr., and its variety *moor
anus*, W. G. Binney, were found at all places with the last. A few were unde
logs, either adhering to them, or buried in the soil beneath, but they were mo
plenty under leaves and brush, lying almost at the surface of the ground wit
the opening upwards. The two last species were very plenty, and they with *H
roëmeri*, *P. texasiana* and various species of *Unios* were found fossil in the pos
pliocene formation.

7. Strobila labyrinthica, Say.

8. Hyalina minuscula, Binney.

9. Pupa fallax, Say.

10. Pupa contracta, Say.

11. Pupa rupicola, Say.

These five specimens were found very sparingly in the river bottom. Of *P
fallax*, I obtained but a single specimen, and that a dead one.

12. Hyalina indentata, Say, was found in small numbers with the latter, an
also on the bluffs. They were six mm. in diameter.

13. Succinea grosvenorii, Lea, were obtained in considerable numbe
around a pond and at other damp places, under sticks or weeds, and in som
cases crawling around.

The search for land shells was pretty thorough, and the absence of eve
dead shells of any other species, shows that the list would not be much extende
by both summer and winter collecting.

In the case of fresh water shells the search was not as satisfactory or com
plete. *Lymnæa* and *Physa* were still active; though I found dead *Planorbis*
various places. I did not get any living ones.

14. Planorbis trivolois, Say.

15. Planorbis parvus, Say.

16. Sphærium partumeium, Say,

These three were found in one pond, but were all dead.

17. A few miles from the town on the edge of the prairie, I noticed a sma
stream of water coming from a spring, and on examination I found a small globo
Lymnæa of about five whirls, and only four mm. in length. From the numb
of whirls and the solidity of the shell, I took it to be a mature one, but a fe

ods further up, in the spring, were shells twelve mm. in length and six and one-half to seven whirls, and these were probably the mature shells of the same species. In other streams the shells were more globose, the suture more impressed, of one whirl less and two mm. less in length.

18. Of the *Physas* there seemed to be three varieties, though they would all, perhaps, be considered as *Physa Neterostrophe*, Say. One of about the typical hape is only nine mm. in length, with six whorls. The second is fourteen mm. n length with seven whirls. The third, while as wide as the last, is two or three nm. shorter, and nearly one whorl less. It has considerable resemblance to *Physa ancillaria*, Say. All three of these varieties are very fragile.

There are doubtless several other water shells in addition to the *Unios*. I ound several species of the latter, but my opportunities were not sufficient to attempt making a list of what may be found.

The difference between the shells found here and at points only a hundred niles away, is very great. I have found various species at Denison which are not ound here, and some that are plenty here do not extend to that part of the State. The conchology of our country cannot be properly understood until specimens and facts are gathered from every hundred miles, or even shorter distances. When that is done, theories can be given and conclusions reached without so nuch of guess-work or imagination as now.

ASTRONOMY.

THE SAROS AND THE TOTAL ECLIPSE OF 1806.

BY WM. DAWSON, SPICELAND, IND.

Having lately found much interest and practical value in the use of the aros, I thought perhaps other tyros of astronomy might also find entertainment n some instruction on this point. Possibly some readers of the REVIEW may ot know what I mean by Saros. It is the Chaldean Period of 18.03 years, after which eclipses of the sun and moon recur in nearly the same order and kind as hey were before. That is, you take the time of an eclipse—say June 11, 1881, t midnight or 12h., and add 18.03 years, you get the time, very nearly, of nother eclipse of the same kind, and this addition may be carried on for ages in he future without missing the time of recurrence of an eclipse more than a few ours—half a day at most. And all eclipses that we ever have of both sun and noon, recur or have occurred in the same way and order in this respect. This eriod is believed to have been found out by the ancient Chaldeans and used by hem in predicting eclipses. True, it does not show the time of any individual clipse to a minute or second, as the adept mathematician obtains by long and

tedious processes of calculation. But it is easy to learn and quick to use; and what tyro in this line would not be truly gratified, after half a minute's calculation, with ascertaining by his own work the nearest hour or so when an eclipse, 18.36 and so on years in the future, will take place. He may find also when they have occurred in the past. An almanac for any year will give a starting point in the matter, for there is no year without two eclipses. There are generally four; occasionally six, and never more than seven in one year.

If you have taken the pains to gather up the almanacs for eighteen consecutive years, or in some other way have obtained a catalogue of all the eclipses that occurred in this period, then you have the times at which seventy of these interesting phenomena of the heavens took place—forty-one of the sun and twenty-nine of the moon. This would afford quite a basis for operation.

I presume that most, if not all, readers of the REVIEW understand what eclipses are, and what causes them; that an eclipse of the sun must occur at new moon and an eclipse of moon at full moon. In passing we will glance at the nodes and lunations. You know that the moon's orbit, or path, is slightly inclined to the earth's orbit, which is the sun's apparent path. This angle of inclination is $5° 8'$. Now the points where these orbits intersect, or cross each other, are called nodes. And that one where the moon crosses the sun's path from north to south is the descending node, and the point of moon's crossing from south to north of the ecliptic is the ascending node. They are on opposite sides of the earth, and a line joining them and passing through the earth is called the line of nodes. Now these nodes are not stationary, but *move backward, or to the west,* on the ecliptic (earth's orbit) at the rate of $19\frac{1}{3}°$ in a year. So that the sun, after passing one node, comes round and meets the same node again about twenty days less than one year, or in $346\frac{5}{8}$ days; and we will call this a node-year. Then nineteen node years will contain 6,585.78 days.

A lunation is the time from one new moon to another, the mean length of which is twenty-nine days, twelve hours, forty-four minutes, three seconds. Now 223 of these lunations are equal to 6585.32 days, a period of time very nearly equal to the nineteen node-years. And here we get the Saros; which in years, days, etc., is eighteen years, about eleven days, seven hours and forty-three minutes. I say *about* eleven days, and there is rather a critical point here which must be observed. When four leap-years come in the Saros, we use eleven days; but there are frequently five leap-years in the Saros, when but ten days can be used with the eighteen years. And at the close and beginning of centuries which do not contain 400 without a remainder, sometimes only three leap-years occur in the Chaldean period, and then we must count in twelve days. But the seven hours and forty-three minutes must be used in all cases.

It may be noted that the difference between nineteen node-years and 223 lunations is 0.45 of a day, or nearly eleven hours; and in this time the sun moves $28'$ of arc to or from the node, as the case may be. Note, also, that if the sun and moon are in the line of nodes at the middle of the eclipse, the eclipse will be central on the earth's equator. Then at the next eclipse, when 18.03 years have

passed, the sun will be 28′ from the node to the west; and if it is at the descending node, the eclipse will be north of the equator; for the sun, as it were, has fallen back of the node; that is, the 223 lunations are completed and the eclipse occurs before the sun, in his annual course, has got to the node—while he is yet 28′ back or west of it; and the moon is a little north of the plane of the earth's orbit, which throws its shadow, or the central eclipse, somewhat north of the earth's equator. At the end of the next Saros the sun is another 28′ (now nearly a whole degree) back of the node, and the moon's latitude is a little greater, and the eclipse must be still farther north than the other one was. Now the sun's distance from the node being nearly half of a degree greater for every Saros, and the moon's latitude (distance from the plane of ecliptic, or earth's orbit) near 3′ more, it follows, that, in the course of time, the sun will be so far from the node and the moon's latitude so great that her shadow and the eclipse will be thrown entirely off, and miss the earth at the north pole. And this occurs when the sun is about 18° from the node and the moon's latitude of 1° 33′, which is the extreme limit from the node that an eclipse can take place, on account of the moon's orbit separating from the ecliptic plane. Then no more eclipses of this series could strike the earth until the sun had made near the entire circuit of the moon's orbit; that is, to the extreme of eclipse limit on the other side of the same node. And to go this round would require about 12,000 years. Then the penumbra of the moon's shadow would begin to touch the earth again at the south pole, and another series of Chaldean periods of eclipses would begin their spiral rounds, or eighteen-year visits to the earth, moving northward at each return, by reason of the sun still approaching the node and the moon's latitude getting less and less until about thirty-six periods have come around, when the sun will again be very near the descending node for this series; the moon (at new, or "change") be nearly or quite in the ecliptic plane, and her shadow—the eclipse—midway between the poles; then northward as before. But the eclipses at the moon's ascending node first touch the earth at the north pole, and work southward till they finally wear off and leave the earth at the south pole. Now there being more than seventy—well toward eighty—periodical returns of an eclipse during its passage from pole to pole (nearly 8,000 miles), we see that, on an average, each eclipse is about 100 miles farther north or south than the preceding one; and so it is with all the sixty-one solar eclipses that occur during the eighteen years. And so each of the twenty-nine eclipses of the moon that occur in the same time is at first very small, but grows larger (the moon being more deeply immersed in the earth's shadow) at each return, becoming total about the thirteenth return, and continuing so for twenty-two or twenty-three Saroses; then partial again and growing less and less—but on the opposite side of the earth's shadow—until thirteen more Saroses have returned; after which the moon will miss the earth's shadow; and that series of eclipses be no more visible to earth for many centuries. We thus perceive that the Chaldean series of lunar eclipses continues only about forty-eight periods, or 865 years; whereas the periodic series of solar eclipses last through the long run of about 1,300 years. The moon's ecliptic limit being

about 24° while the sun's is 36°, accounts for the shorter time that the lunar series can be seen from the earth. And the earth's shadow where the moon passes it being smaller than the earth itself, accounts for the shorter ecliptic.

As an example to illustrate the application of the Saros, let us take a total eclipse of the sun which occurred in 1806, June 16th. It was a very large total eclipse and visible in Ohio and New York about eleven o'clock A. M. But instead of using our common twelve-hour division of the day, it is better in calculations of this kind to count the twenty-four hours through, and thus avoid the use of A. M. and P. M., and for the convenience of western readers I will use Kansas City time, which is *about* one hour earlier than eastern Ohio, etc. Then the date to start with would be 1806 6mo. 15d. 22h. In determining the leap-years I have found it convenient to write them in a vertical column, beginning with 4, 8, 12, 16, 20, etc., all through the century. This shows every year which has twenty-nine days in February, and makes it quite easy to ascertain whether we must use 10, 11 or 12 days in any particular Saros. The same column will do for any century.

	MO.	DAY.	HR.
1806 .	. 6	15	22
18 .	. 0	10	8
1724 .	. 6	26	6
18 .	. 0	11	8
1842 .	. 7	7	14
18 .	. 0	10	7
1860 .	. 7	17	21
18 .	. 7	11	8
1878 .	. 7	29	5
18 .	. 0	10	8
1896 .	. 8	8	13
18 .	. 0	12	7
1914 .	. 8	20	20

We observe that the first period, 1806 to 1824, has five leap-years; that is, the 29th day of February occurs five times before the period ends, which is in June. So we must add only ten days with the eighteen years. It may be observed that if the Saros ends before the 29th day of February, that leap-year is not to be counted in that Saros; but if after that day it must be. It may be noted also that the seven hours and forty-three minutes is not always the *exact* part, or fraction, of a day to the actual occurrence of the eclipse. It is only the mean, or average, part of the day for all periods. There are slight irregularities in the moon's motions which can only be got at by a tedious process of calculation. So that the nearest hour is quite sufficient for our purpose. Hence we add eight hours twice (in two different periods), then seven hours once, and so on. So we obtain 1824 6th mo. 26th day, six o'clock in the evening, Kansas City time, for the date of the return of the 1806 eclipse. The sun not being then set the eclipse must have been visible over northwestern America and the Pacific Ocean.

You may observe too, that, the eclipse being nearly eight hours later in the day than the preceding one, it must be about one-third of the way round the earth farther west than its predecessor. The next Saros having but four leap-years, we add eleven days to six months and twenty-six days and have six months and thirty-seven days, from which subtract the thirty days of June, and we obtain for the next eclipse, 1842, July 7th, two hours after midnight. Of course it could not be seen here, the sun being away below the eastern horizon. But in the early morning of July 8th, the people of eastern Europe had a fine view of one of the grandest eclipses of modern times. It was then that the red flames

and sublime corona began to attract great attention from the most gifted astronomers. Total eclipses occurred in other parts of the world, as that of 1851 in Norway and Sweden, whither great numbers of observers proceeded for the observation of these important phenomena. And in 1868 a goodly number of interested astronomers visited Arabia, etc., where they saw another total eclipse of the sun, and found evidence that the red flames, or tongues of light, were of a gaseous character, and perhaps were vast flames of burning hydrogen on the solar surface. But to our Saros: The above calculation gives, when reduced from astronomical to civil time, July 18, 1860, nine o'clock in the morning, for another eclipse in the 1806 series. And on the third return, fifty-four years and one month, it ought to be visible in Ohio, etc., again. But it would only be a partial eclipse; for the central shadow of the moon—the belt of totality, had gone northward about 300 miles. I well remember seeing this eclipse about eight o'clock that morning. The Saros time was one or two hours too late—a small matter though for more than fifty years' time.

Doubtless many persons remember the solar eclipse of 1878, July 29th, about three or four o'clock in the afternoon. The total belt ran from Behring's Strait near the Pacific coast, but a fine partial eclipse (about half the sun's face) was visible even here. It was raining for some time after the eclipse began; but the clouds broke away in time for a fine observation of the greatest phase. Rain was falling again, however, before the eclipse ended.

I have often noticed and heard of such *clear spells*, as if by special Providence to allow observations of eclipses and other interesting phenomena.

The next return, 1896, August 8th, about midnight, being on the opposite side of the earth, we will see nothing of it here. Now we come to the close of a century, the last year of which is not a leap-year; and there are but three Februarys having twenty-nine days in that Saros, so twelve days must be added with the eighteen years and seven hours to obtain the day of next return; which, according to Rev. S. J. Johnson in his book, "Eclipses Past and Future," will be at noon August 21, 1914; corresponding well enough with our calculation, making allowance for difference of longitude. He says "it will be a most striking phenomenon"—visible in Norway and Sweden. "At London two-thirds of the sun's disc will be eclipsed." Adding another Saros of eighteen years, ten days and eight hours, we get 1932, eight months, thirty days, four hours. I do not find any record of this eclipse; but it certainly will occur very early in the afternoon of that day, and be visible to Kansas City as a small eclipse of the sun. Johnson does not mention the return in 1950, but that of 1968, September 22d, at ten A. M. (London time), he gives as obscuring one-third of the sun's diameter. The line of totality must then be near the north pole, but the partial eclipse will continue in the arctic regions, growing less and less at each returning Saros until the year 2347, May 11th, seven o'clock in the morning, when, according to my own calculation, the southern edge of the moon will overlap the north side of the sun, about 0.08 of the sun's diameter—nearly one digit by the old way of noting the magnitude of an eclipse. To determine this matter requires a process of compu-

tation more tedious and accurate than can be done by the Saros. And so I find that in eighteen years more, viz., 2365, May 21st, at two P. M., the shadow of the moon seems to miss the earth entirely. And now it must continue to traverse the void expanse of space for the long period of nearly thirteen thousand years before it again touches the south pole of the earth to begin another series of spiral visits northward on the mundane sphere.

Now, we may find when eclipses of this series occurred previous to 1806 by subtracting the Saros period. Then from 1806, six months, fifteen days and twenty-two hours take eighteen years, twelve days and eight hours, and we have 1788, June 3d, two hours past midnight, Kansas City time. By reference to a long catalogue of eclipses in Ferguson's Astronomy, I find that this eclipse—that is, one eclipse in this series—was visible at London 1788, June 4th, at nine A. M.; which is very near our Saros time—allowing for difference of longitude. Then from this date we subtract eighteen years, ten days and eight hours and get 1770, May 26th at 6 P. M., which would be visible in western Asia and the Pacific (each preceding eclipse being visible eastward instead of westward, as when we added the Saros). So we might trace backward period after period for several centuries, and obtain, nearly, the times when this eclipse has been visible in the remote past. But remember, it has been going northward at every succeeding period; and as we go backward, it was farther south in the preceding periods. It was central on the equator, I think, about 1700. The farthest back, or earliest record, that I find of this eclipse was 1572, January 25th, at seven A. M., London time. At this hour in the morning the sun had not risen at London; but the eclipse must have been visible as a total eclipse in southern Africa. I have not applied the Saros back to this date, but calculation by a different process agrees exactly with the record. By a careful and somewhat tedious computation I obtain the date of 1049, March 12th, when this eclipse first came on the earth at the south pole. In 1031, March 2d, the moon's shadow seemed to nearly graze the earth, and at the next return in 1049 was fairly on; so that, from the south pole, the moon would seem to cover about one-twentieth of the sun's diameter. Although this eclipse was largely total when it passed over Ohio in 1806, yet my computations indicate that it was annular when it first struck the earth in 1049. That it became total about the time of its return in April, 1103, and will continue so until 1969, when it will again become annular; that is, the moon will get farther from the earth and appear less than the sun.

Not having found in any work on astronomy an account of this change from annular to total eclipse, I had always thought that if the eclipse was annular when it began to appear on the earth, it would continue so during its whole periodical round of a thousand years or more. But I find in these calculations a slow and continuous change in the relative distances of the sun and moon from the earth, Saros after Saros causing a change from the ring to the total eclipse. Then, to summarize a few of my results in reference to the solar eclipses of 1806, 1878, etc., viz: It came on at the south pole of the earth as an annular eclipse March 12, 1049; became total April 15, 1103; reached the equator—middle of its spiral

course on the earth about 1700; visible as a total eclipse in our latitude, June 16, 1806; becomes annular again about 1968, September 22d, and finally passes off or leaves the earth, at the north pole, May 11, 2347.

Hence this eclipse will have continued its eighteen-year visits to the earth during 1298 years and two months; having made itself visible on some part of the globe seventy-three times—making seventy-two complete Saroses. When it first struck the earth in 1049, it appears that the sun was 16° 13′ east of the moon's descending node; and when it leaves the earth in 2347, that the sun will be 17° 12′ west of the same node; having gone backward through an arc of 33° 25′ of the moon's orbit, which in this case would seem to be the "ecliptic limit." Now as the sun will have retrograded (with reference to the Saros) 33° 25′ in 1298 years, to go around the remaining part of the moon's orbit, *i. e.*, 360° 00′ —33° 25′=326° 35′, will take 12,687 years, the time that must elapse before this eclipse can fall on the earth again. Now, these results being only those of my own investigation, I do not claim absolute accuracy for them, but feel satisfied that the most elaborate computer will not find them greatly in error.

In contemplating that about forty-one such eclipses as this, and twenty-nine eclipses of the moon, are each one all the time making their periodical rounds of eighteen years about the earth, there might seem, at first view, to be an irregular and uncertain clashing, as it were, of dates and shadows, with other phenomena of eclipses, which could hardly be reconciled. But it is a fact absolute, that the various and intricate motions of the earth and moon are so well known that their positions with each other and the sun can be obtained at any time; and thus the dates of all these seventy eclipses foretold to within a few seconds of the times of their occurrence, for many years in the future.

"Great and marvelous are thy works, Lord God Almighty. Just and true are thy ways, thou King of Saints."

HOW TO WEIGH THE SUN.

BY EDGAR L. LARKIN, NEW WINDSOR OBSERVATORY, ILL.

There are several methods, and we select the most elementary in the attempt to make the case clear by the use of words instead of mathematical symbols, if such a thing is possible. Useless sentences must be written where, if the subject were treated mathematically, a few Greek letters and algebraic formulas would express all in clearer terms. What we shall say is intended to assist youths just beginning to expand their minds in the study of astronomy; and we will be pleased to receive letters from all such students between the ages of twelve and seventeen years, who have read this article and are interested in the noblest of all sciences.

Gravity.—If a body at rest begins to fall, it will fall sixteen and one-twelfth feet, or 193 inches, the first second; but at the end of the second, it will be moving at the rate of thirty-two and one-sixth feet, or 386 inches, per second. Among

all the millions who lived before Newton, not one knew this fact to be valuable. But it is one of the most important elements of human knowledge, since none can learn much of nature, nor understand what kind of a world they are living in, nor comprehend the solar system, without first knowing all the results derived from this great fact. Let us see what it enables man to know. First, the velocity, 386 inches per second, acquired at the close of the first second of fall, is a measure of the gravity of the earth. It shows that a mass of matter of the size, shape and density of the earth, attracts with a force which, acting one second on bodies near its surface, is able to impart to them that velocity. For ordinary purposes of life we express gravity in terms of weight, and use scales graduated to arbitrary standards to compare the force of attraction of the earth on different bulks of matter. We take a piece of iron and say, by agreement, that it is one pound. That is, the mass of the earth attracts it with a force the measure of which we call a pound. Now if we let the iron fall from a high building, we shall find that at the end of a second it will be in motion with a velocity of thirty-two and one-sixth feet per second, therefore it is plain that if the nations of the world agree to call this velocity generated in one second a measure of the earth's attraction, scientists can write letters from one country to another, and speak of gravity in terms of motion as well as they can in terms of weight. And physicists all over the world have made such agreement, and have adopted one second as the unit of time, and velocity of 386 inches as a measure of gravity exerted by the whole mass of the earth. But this method of measuring gravity is used only in astronomical and physical research into the mysteries of the universe, the plan of expressing attraction in terms of velocity being preferable.

When clocks were perfected, it was found that one keeping exact sidereal time in London would lose if taken to the equator. Or, carry a clock that keep precise time at the equator, either north or south, and it will gain; the further we recede from the equator, the faster the clock will run. These facts seemed inexplicable until a clock that kept accurate time on the surface of the earth was taken into a deep mine and also found to gain. It is evident that the reason why a clock gains as it is carried toward the poles, is because in so doing we draw a little nearer the centre of the earth. Then the idea came into men's minds that gravity is variable; and that its variation is connected in some way with distance from the earth's centre. And by pendulum experiments it is found that if we could reach the poles of the earth, we should be thirteen miles nearer its centre than if at the equator. Hitherto philosophers had thought gravity constant, but now they made a discovery of vast importance; they found that it is not the same everywhere on the earth. But then, if the pendulum varies its number of vibrations with latitude, will not the velocity of a falling body vary in the same ratio? Delicate tests were made in many latitudes and at the equator, when behold! the further we go away from the equator, the greater velocity will a falling mass acquire at the end of a second. But the whole increase in velocity from the equator to the poles, is only 1.97 inches; while the difference in distance from the centre of the earth is thirteen miles. The great question arose

just before Newton, what is the *law* of variation? And there was not found one among men able to solve the problem.

Before we proceed, it will be well to remark that physicists at that time did not know the amount of variation of velocity at different points on the earth's surface as we do now. They did not have mathematically exact clocks nor refined instruments of measurement; all they had as a basis to work on was an impression, simply, that gravity varied slightly, and that this variation depended in some way on distance from the centre of the globe. These things render more remarkable the achievement of Newton. Let us now, along with that great man, begin a search for hidden law, and propound such questions as these to our own minds, as he did: How great a velocity will a falling body attain in one second if let fall from heights of five, ten or fifty thousand miles above the surface of the earth? How shall we learn? we cannot reach these altitudes; is there no way to find out? There is,—but none save Newton can tell us. Let us see; the moon is above the surface of the earth, and if gravity reaches that far, it must be a falling body. Conceive the earth and moon to be called into existence instantly, then the moon must begin to fall toward the earth at once, since our world contains eighty times as much matter. And if the attraction of the earth is as strong there as it is on its surface, the moon, at the termination of the first second of its fall, must be moving with a velocity of 386 inches per second, directly toward the centre of the earth. Now we all know that the moon does not approach the earth, although terrestrial gravity is exerted upon it all the time, making it tend to fall; and fall it would, did there not exist some force able to hold it back. What is this force? Tie a cord to a stone, and revolve it rapidly around the hand; the string will be found to pull with a force which varies in some ratio to the velocity. Make the stone revolve twice as fast, and even with the hand it can be detected that the pulling sensation is more than twice as strong as before; while with instruments it is demonstrated that the centrifugal force varies as the square of the velocity. So with the moon; its velocity generates centrifugal force which draws against the attraction of the earth precisely as the stone against the hand. Behold! we are in the midst of an inductive process which leads to a law of Nature. Is it not clear, that, if we can find how much centrifugal force is evolved by the motion of the moon, we shall at once know how strong the earth attracts at that distance, since we already know these two forces are equal, because the moon does not come nearer the earth? But how shall we find the centrifugal force of the moon? It is developed by analysis that if a body in space revolves around another with velocity sufficient to prevent gravity from causing them to approach, the velocity of the revolving body must equal the square root of the product of gravity multiplied by the radius of its orbit. The mean equatorial radius of the earth is 3962.72 miles, and the mean distance of the moon is just sixty times as much, or 15,064,676,352 inches. And the force of gravity exerted by the earth at the distance of the moon, let us assume, is equal to a force which, acting one second, could make the moon move in centripetal fall, at its close, with velocity of 386 inches per second. Now multiply the above number by 386,

extract the square root of the product, and we shall have 2,411,631 inches per second, through which the moon must move in orbital flight to make centripetal force equal gravity and keep it from falling.

But we should have strange times on the earth; we should be blessed with more than two moons every day, for with this velocity the moon would make a revolution in ten hours fifty-five minutes, giving us new moon in the evening, say at 6 o'clock P. M., and full moon before midnight. We could see it move, and would wonder at the unusual aspect of Nature. Hence we are sure that gravity is not any where near as strong at the moon's distance as on the earth's surface. Let us try again, and since the moon is sixty radii of the earth away, conceive gravity to be one-sixtieth as strong. Divide 386 by sixty, and the quotient is 6.4333 inches, which we will assume as the velocity gravity can impart in one second at the moon's distance. Using this as a multiplier in the same computation as before, and we obtain orbital velocity per second of 311,152 inches to balance gravity. By dividing the circumference of the lunar orbit by this number, we find the time of revolution, which is three days, twelve hours and thirty minutes, and are assured that gravity is far less than one-sixtieth of what it is on the earth, because the moon requires over twenty-seven days to make circuit. We have not yet found the law, and how shall we proceed? Is the problem capable of solution? Let us take a reverse method and begin with the actual velocity of the moon on its orbit, and see how much attraction the centrifugal force generated by that motion balances. Centrifugal force produced by a revolving body is equal to the square of its velocity, divided by the radius of its orbit. The moon goes around the earth in 2,360,591 seconds, with velocity of 40,098 inches per second. Square this velocity and divide the product by the number of inches in the mean distance of the centre of the moon from the centre of the earth, and the quotient will be 0.1072 of an inch. That is, the centrifugal force developed by the moon's orbital motion is equal to a force which, acting one second on a body at rest, could at the close of the second cause it to move with that velocity per second. But we know this force to be equal to the gravity of the earth at the distance of the moon, because the moon does not come any nearer. Now how much weaker is this gravity than it is on the surface of the earth? Divide 386 by 0.1072 and the quotient is 3,600; it is 3,600 times less, but behold 3,600 is the square of sixty, and sixty is the ratio of the distance of the moon from the centre of the earth to the distance of the surface of the earth from its centre. The mighty mind of Newton saw the great results of this law, as they would be developed from age to age; and his intellect beheld that in time to come, it would enable man to weigh suns so distant that light requires years to traverse the awful chasm to reach our world. Newton published the law and rendered his genius the subject of admiration so long as intellectual man shall inhabit the earth. It is this: "Every particle of matter attracts every other directly as to mass, but *inversely* as to distance squared."

Weighing the Sun.—When we wish to weigh anything we must have scales; but what scales will weigh the solar mass? How shall we begin; and when we have told its weight, how shall we know it to be correct?

Our balance shall consist, not of instruments of steel, but of *motion*, whose amount is only 386 inches in one second, or that velocity developed at the close of a second on an insignificant world more than 92,000,000 miles away from the great sun it is proposed to handle! How absurd such an undertaking seems, but no matter; men became bold as soon as they learned that gravity varies as distance squared inversely, and attacked problems that would have appalled the human intellect before.

The distance of the centre of the sun from the centre of the earth is 23,440 times greater than the surface of the earth is from its center. We know gravity to be measured by the 386 inches, at a distance of 3,962.72 miles from the centre of our earth; how much will it be weakened at a distance 23,440 times as great? The law says it will be lessened as the square of the ratio of the distance, inversely; hence, 23,440 squared equals 549,433,600; that is, gravity will be diminished that many times at the sun's distance. Divide 386 by this number; the quotient will be .00000070254 of an inch velocity, at the end of a second, that the attraction of the earth is able to impart to a falling body that far from its centre. Proceeding as we did in the case of the moon, we multiply the number of inches from the centre of the earth to the centre of the sun by the force of gravity, or the decimal given, resulting in 4,134,635 inches per second, which is the square of the velocity with which a body at that distance must move in order to counteract that much attraction and not fall. Extracting the square root, we have 2,033 inches per second as the real orbital motion. Now, by finding the number of inches in the circumference of a circle having the above radius, and dividing by 2,033, we find the time of revolution, 576.3657 years. But to make circuit in one year it must move 576.3657 times as fast, or 1,171,751 inches per second.

It is clear that if we can find how much centrifugal force this velocity generates, we shall at once know how strong gravity is at that distance, and how much matter is required to exert that attraction. As before, centrifugal force is found by dividing the square of the velocity by the radius of the orbit. Therefore 1,171,751 squared equals 1,373,000,406,000, which divided by 5,885,266,907,-520, the inches in 23,440 times the earth's mean equatorial radius, or the mean distance of the sun, gives a quotient of .233 of an inch per second, velocity generated at the end of a second by a force equal to the centrifugal force found acting during that time.

But this is also equal to gravity; now, how many times stronger is it than what we found by dividing 386 by the square of the distance? We find how much by dividing .233 by .00000070254, and find it to be 331,654 times as great. Hence, the earth must become 331,654 times heavier than it is to make a body at the sun's distance revolve around it in a siderial year, and not fall. Since the

earth revolves around the sun in a year, we have demonstrated the sun to be that many times greater in mass than the earth.

PROOF.—How are we to be satisfied that this result is correct? The distance to the sun is known; and the time of the revolution of the earth around it, which is 31,558,149 seconds; we know the number of inches in its orbit, and of course the number traversed in a second. Draw a tangent to the orbit of the earth, and let the centre of the earth be at the point of tangency; in one second it will be 1,171,751 inches away, but the centre will be .1165 of an inch nearer the sun than the tangent is, showing that the world falls that far every second from where it would have been had not solar gravity drawn it away from the tangent; because, if in whirling a stone the cord should break, the stone would fly away on a straight line tangent to the circle in which it moved. But .1165 of an inch is the half of .233, and 16 1-12 feet is half of 32 1-6 feet, the velocity attained by a falling body on earth; that is, the velocity acquired by a mass falling from a state of rest is, during the first unit of time, equal to twice the space fallen through. Hence it is seen that geometrical analysis of the orbit traversed by the earth gives the same value, precisely, for solar attraction that is found by the more elegant method of using the velocity, 386 inches, as an instrument of weighing. We have simply deduced ratio of mass; that is, call the weight of the earth one, and that of the sun is 331,654. Now, if we can find how many pounds the earth weighs, the weight of the sun, in pounds, can easily be computed. From most delicate pendulum and other experiments, it is found that the mean density of the whole earth is 5.66, that of water being one. A cubic foot of water weighs 62.-594 pounhs; hence, a cubic foot of the earth weighs 5.66 times as much, or 354.28 pounds. Find the cubic feet in the earth, multiply by this factor, and that by the ratio of weight of the sun to that of the earth, and the product will be the number of pounds of matter in the sun.

NEW WINDSOR, ILL., February 1882.

ASTRONOMICAL NOTES FOR MARCH, 1882.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.	Declination S.	Equation of Time.
1st.	22h. 50m.	7° 25′	12m. 27s. +
10th.	23 24	3 56	10 19
20th.	0 00	0 00	7 29
31st.	0 40	4 18 N.	4 08

On the 20th at 11h. A. M., it will enter Aries, pass the celestial equator and Spring will commence.

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Transit.
1st.	21h. 50m.	10° 15′	11h. 08m. A.M.
5th.	21 47	11 32	10 49
10th.	21 51	12 21	10 34
15th.	22 04	12 17	10 27
20th.	22 22	11 27	10 26
25th.	22 44	10 00	10 28
31st.	23 09	7 25	10 34

Apparent diameter on the 1st, 10.2″; on the 31st, 6.2″.

VENUS.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Transit.
1st.	23h. 00m.	7° 56′	00h. 22m. P. M.
10th.	23 41	3 29	00 28
20th.	0 27	1 35 N.	00 34
31st.	1 17	7 08	00 41

Apparent diameter on the 1st and 31st, 10″.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	6h. 04m.	26° 21′	7h. 25m. P. M.
10th.	6 16	26 07	7 02
20th.	6 32	25 46	6 38
31st.	6 52	25 15	6 15

Apparent diameter on the 1st, 10″; on the 31st, 8″.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	3h. 11m.	17° 03′	4h. 33m. P. M.
10th.	3 17	17 27	4 04
20th.	3 24	17 56	3 32
31st.	3 33	18 28	2 57

Apparent diameter on the 1st, 35.4″; on the 31st, 33″.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 25m.	12° 07′	3h. 48m. P. M.
10th.	2 28	12 25	3 15
20th.	2 32	12 46	2 40
31st.	2 37	13 11	2 01

Apparent diameter on the 1st, 16.2″; on the 31st, 15.4″.

The elevation of the earth above the plane of the ring, 19° 50′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	11h. 12m.	5° 59′	00h. 36m. A. M.
31st.	11 07	6 28	10 30 P. M.

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
15th.	2h. 50m.	14° 32′	3h. 10m. P. M.

PHENOMENA.

On the 5th at 3h. 37 A. M., conjunction of Uranus and the Moon. Uranus north, 6° 06′.

On the 6th, at 10h. 00m. P. M., opposition of Uranus and the Sun.

On the 7th, at 6h. 00m. A. M., Mercury stationary in R. A.

On the 17th, at 11h. 00m. A. M., conjunction of Mercury and the Moon.

On the 19th, at 10h. 23m. A. M., conjunction of Venus and the Moon. Venus south, 5° 47′.

On the 20th, at 11h. 00m. A. M., the Sun enters Aries and Spring commences.

On the 21st, at 5h. 00m. A. M., Mercury at greatest elongation, west 27° 46′.

On the 22d, at 5h. 00m. A. M., conjunction of Saturn and the Moon.

On the 22d, at 11h. 00m. A. M., conjunction of Neptune and the Moon.

On the 23d, at 2h. 00m. A. M., conjunction of Jupiter and the Moon. Jupiter south, 1° 23′.

On the 26th, at 4h. 40m., conjunction of Mars and the Moon. Mars north, 5° 39′.

On the 31st, at 4h. 00m., Mars at greatest heliocentric latitude north.

St. Louis Academy of Science, February 6, 1882.

Prof. Pritchett made a short communication on double stars. He stated that some stars were found to have a periodic motion such as had been observed in double stars which revolve around the common centre of gravity. Of these Sirius was one, and a German astronomer calculated the position of a companion star which would produce the observed deviations. This companion star was afterward discovered by Clark, when the Chicago telescope was turned upon it. It had also been observed that Procyon had a proper motion similar to that of Sirius, and attention was at once drawn to it in the confident expectation that a similar explanation of its variable proper motion would be obtained. Up to the present time, however, no satisfactory evidence has been given of the existence of such a companion, although the search has brought out some curious results. Some years ago, Prof. Otto Struve, Director of the Pulkova Observatory, announced the discovery of a close companion, and although no other astronomer was able to see it, Struve continued to measure the companion for two years. At the end of

this time, however, he concluded that the object he had observed was a spurious one, caused by a double reflection of the light from object-glass and eye-piece.

With the great twenty-six-inch equatoreal at Washington, a systematic search was commenced, in 1876, for companions of Procyon, a number of observers taking part. Of these, the majority never saw any companion; two or three were uncertain, while two or three others saw from two to eight companions at different times.

METEOROLOGY.

ON THE CAUSE OF THE ABSENCE OF TREES ON THE GREAT PLAINS.*

BY LESTER F. WARD A. M.

The many fine-spun and often puerile theories that have been advanced by men of greater or less scientific reputation to account for the treeless condition of a large part of our country, are responsible for the continued prominence of this old and familiar question. The latest utterance on the subject comes from Prof. Thomas Meehan in the form of a "Note on Treeless Prairies,"† in which, to his credit be it said, he has undoubtedly given the proper solution to the problem, so far as the proper "prairies" are concerned, namely, that they are due in the main to the annual fires that have from time immemorial swept over these areas. This conclusion, however, is far less fresh than the language in which it is announced would imply that he regarded it. Dr. C. A. White, then State Geologist of Iowa, in his annual report for 1870,‡ expresses his view as follows: "It now remains to say, without the least hesitation, that *the real cause of the present existence of the prairies in Iowa is the prevalence of the annual fires.* If these had been prevented fifty years ago, Iowa would now be a timbered instead of a prairie State;" and Dr. Alexander Winchell remarks§ that "The old and popular belief was that which attributed their treelessness to the annual burning of the grass by the Indians."

Born and raised in the prairie region, I can fully confirm the testimony of these two Western men, and add that this explanation was the only one that I am aware of having ever received any serious attention from the class of practical people whom I was accustomed to hear speak on the subject; all others being dismissed as the efforts of over-learned persons to give some other reason for things than that dictated by plain common sense. The formal ratiocination by

* Read before the Biological Society of Washington, December 9, 1881.
† Proc. Acad. Nat. Sci., Phila., Feb., 1881.
‡ Vol. I, p. 133.
§ Sketches of Creation, 1874, p. 266.

which Prof. Meehan establishes his conclusion was as familiar to my childhood as the alphabet, and its extreme simplicity is virtually acknowledged by him a few lines lower on the same page, where, speaking of Indians, he admits that "Low as their power of reasoning may be, they could not but have perceived that while grassy herbage throve in spite of fires, perhaps improved under the fiery ordeal, trees could not follow on burned land. What could be more natural than that they would burn the prairies with the object of retaining food for their wild animals." Certainly what savages could reason out *a priori*, white men ought to be able to account for *a posteriori* with all the data at hand; and this they certainly have done from the first, and refused to be befogged by any of the other specious reasoning already referred to.

But the problem of the "grassy prairies" and the problem of the Great Plains are not identical. When we extend our inquiries to embrace the broad expanse that stretches westward from the Missouri and the western boundary of Arkansas to the base of the Rocky Mountains, we encounter a new class of phenomena which require to be accounted for on a different principle.

The investigation is, however, seriously complicated by the fact that between the very distinct conditions that characterize the typical prairies and the typical plains there is geographically no precise line of demarkation, the one passing into the other by rigidly insensible gradations.

In traveling westward from Kansas City or from Omaha, one passes through an almost completely treeless region for a distance of five or six hundred miles. A careful observer will, however, perceive that the eastern portion of this great plain differs in many respects from the more central or western portions, and that it may therefore be divided into two general areas, which, however, blend together and do not admit of being clearly marked off from each other. If it could serve any useful purpose to draw an arbitrary line to denote approximately the western boundary of the one and the eastern boundary of the other, this line might perhaps be made to coincide with the 100th meridian, which passes through western Kansas and central Nebraska. For a moderately limited north-and-south range, this line does not fall far from that represented by an altitude of 2,500 feet and an average annual rain-fall of twenty inches.

In point of fact, as regards this latter, which is of chief importance to our subject, the twenty-inch isohyetal, if followed southward from the Missouri River, which it crosses at a point near Yankton, or about on the 98th meridian, bears westward and touches the Kansas and Nebraska State line almost exactly at the 100th meridian. It continues slowly to bear westward and reaches the 101st meridian at the southern boundary of Kansas, crossing it, but returning to it at the Rio Grande, which it follows thereafter very closely to near its mouth.

This line as thus described would, therefore, still more nearly represent the imaginary boundary of these two treeless areas.

As we approach this line, proceeding westward, the grassy character of the plains gradually disappears, the typical prairie vegetation is changed and gives place to a new class of plants which are for the most part represented by three

dominant types: 1st. Those having thick succulent stems for storing up moisture, of which the cactuses are the best examples. 2d. Those having large and deep roots, such as *Ipomœa leptophylla*, the bulk of which is really subterranean; and 3d. Those having either glandular, hairy or woolly surfaces, belonging to numerous families, but chiefly to the *Compositæ*, the *Borraginaceæ*, and the *Leguminosæ*. Large interspaces of bare ground occur between the more and more sparse occupants of the soil; grass, when seen at all, appears in small, disconnected bunches; the face of the country assumes a dull, leaden hue, and the transition at length becomes complete.

A sojourn upon the plains for a short period reveals other marked peculiarities. The eastern sky is frequently seen lit up on summer evenings by flashes of lightning, and by day a bank of cloud may often be observed hanging low along the eastern horizon while all is dry and arid at the observer's station. Or, looking to the westward, heavy showers may be seen to gather upon the mountains, only to thrust a few spent cloud-columns over the parched regions below.

The prime cause of the changes in the vegetation above pointed out is therefore of course not far to seek. The scanty rain-fall would seem alone sufficient to account for it. After passing the western boundary of Kansas, the annual precipitation is but sixteen, and falls as one proceeds farther westward to twelve inches. The same is true throughout western Nebraska and Dakota and eastern Montana. At Denver it is 14.09; at Cheyenne, 13.77; at Fort Lyon, Col., 12.56; at Fort Stevenson, Dak., 11.84, and at Fort Rice, Dak., 11.39 inches.

Any country whose annual rain-fall is less than ten inches is a true desert, and we see how closely this great region approaches this condition at certain points. It is only rarely, and this either in natural depressions or in the vicinity of rivers, that green patches of buffalo grass, *Bontelona oligostachya* or *Buchloë dactyloides*, may be seen, possessing anything that can be called turf, and the face of the country has, to a large extent, the general aspect of a desert.

But if this deficient rain-fall accounts for the absence of grass and the other herbage characteristic of the East, is it sufficient also to explain the absence of trees? And if so, why is the country not timbered out to near the 100th meridian?

The first of these questions should, I think, be answered affirmatively. As to the second, it has already been answered at the beginning of this paper. It is, I believe, indeed true that there are no trees on the plains because they will not grow there, and it may be this opinion, (which *is* somewhat prevalent,) that Prof. Meehan has confounded with a similar explanation of the more eastern prairies; for at the beginning of his paper he remarks that "The most prevalent belief had been that trees would not grow on these prairies," a statement which is very wide of the truth for the prairies proper.

This view may be substantiated by a few facts:

1. It is not possible to account for the absence of trees on the plains on the theory of fires. Fires do indeed occur but not frequently or extensively. The vegetation is scarcely dense enough to support them. The testimony is conflict-

ing with regard to their extent and frequency even among those who have lived many years on the plains. My own inquiries, made of such persons, confirm the above statement.

2. All successful attempts to make trees grow on the plains have been made in irrigated districts, which is of course no test of their ability to grow in districts not irrigated. At least one unsuccessful attempt has been made, viz., that of the Kansas Pacific Railroad Company to plant them along their line.

3. It is true that three cottonwoods, *Populus monilifera*, *P. balsamifera*, and *P. balsamifera*, var. *angustifolia*, grow spontaneously along the valleys of streams in some places, one of which, *P. monilifera*, is often found far out on the plains. These, however, rather substantiate than disprove the theory here advanced, since, if the timber were destroyed by fires, the cottonwoods would share the common lot of all. In fact they furnish still stronger proof against the fire theory, for where they are found is just where the most grass grows, and hence where the fires would be most frequent and destructive. It is therefore safe to say that the general absence of arborescent vegetation is not due, as on the more eastern prairies, to annual fires.

To say that the distance from actual forests is too great for trees to migrate over the plains, would be not only to misapprehend the question, since they would have been there from the first, but would be to betray ignorance of the facility with which vegetation is known to traverse vast areas and find its way across continents, and even hemispheres of the globe. No point on the plains is too remote for the cottonwood to fail to reach it, provided the conditions for its growth exist, and if it be said that the peculiar anemophilous seed of this genus adapt it above other trees for finding a proper habitat, it may be replied that few other trees live in such small areas, so widely separated from one another as to require similar devices for scattering their seed. If the entire plain was capable of supporting a general forest growth, such as once existed in the Eastern States, the individuals of any species would be in such close proximity to each other that propagation by the ordinary methods would be as easy there as here.

The whole subject may therefore be briefly summed up as follows:

Since the elevation of the Rocky Mountain range at the close of the Tertiary age, the atmosphere, in the general easterly movement which it possesses at all latitudes within the United States, has at all times lost the greater part of its moisture by condensation upon the cold summits of these and the more western ranges, so that by the time it reaches the great plains it is too dry for precipitation except under unusual conditions. As it moves still farther eastward across a level country, having river valleys and lake basins, it comes in contact with currents from the north, the south and the east, brought there by the constant disturbances of barometric pressure with which all are acquainted, and in this manner it gradually becomes at length again sufficiently laden with moisture to yield portions of it to the soil when condensed by currents of unlike temperature. This characteristic becomes more and more marked with the eastern movement until the Mississippi Valley is reached, in which and at all points eastward the rain-fall, varying

from thirty-two to sixty inches, is sufficient to be depended upon for agricultural purposes.

Where the annual precipitation is below twenty, or perhaps twenty-four inches, there can be no growth of forests, and this is the true cause of the absence of trees on the great plains. But this does not prevent the existence in arid regions of certain specialized types of arborescent vegetation. The sage brush that covers the dreary wastes of the Rocky Mountain Region, the Laramie Plains, the Bitter Creek Valley, and such vast areas of the West, while in its botanical characters it is little more than an over-grown weed, is to all intents and purposes a tree, and often attains a great age. The region it occupies is even more arid than the great plains, yet no fires occur and no forests grow. In the nearly rainless areas of Arizona, southern Utah and New Mexico, and stretching eastward into Texas, there occur a number of arborescent forms, the creosote bush (*Larrea Mexicana*), the mesquit (*Prosopis juliflora*), various acacias and mimosas. and one yucca (*Y. brevifolia*), together with the tree cactus (*Cereus giganteus*). These grow scattered at great distances from each other and rarely form thickets or groves. Why no such characteristic species are found occupying the great plains is not known, and it is probably a mere accident that none happens to exist, adapted both to their temperatures and their arid condition. Did any such exist, there seems no reason why it might not thrive as well as the sage brush farther west or the mesquit of the south.

The absence of forests or extensive tracts of timber land on those areas of our western country where the rain-fall annually exceeds twenty-four inches, must, as already remarked, be attributed to human agency in repeatedly burning over these areas, whereby all forms of vegetation requiring more than one season to mature their fruit are prevented from perpetuating their kind. The American aborigines have inhabited this continent through a prolonged period of the past, how long we need not here stop to inquire. Ages prior to European discovery they roamed over the great plains, hunting the buffalo, and through the forest-clad wildernesses to the eastward, hunting the deer, the elk, and the other large animals that belonged to the fauna of the country. Doubtless they found it advantageous to locate themselves at points near the boundary line which separates these great are as so well marked off by nature, where they could pursue the antelope by going westward or the deer by going eastward.

No human race has yet been found so low as to be ignorant of the art of making fire, and all along this border of the forest region we may imagine the red man's camp-fire to have glowed in periods too remote for profitable speculation. It is wholly unnecessary to assume, as Prof. Meehan has done, that the grass of these border wood-lands was fired intentionally or "with the object of retaining food for their wild animals." It is just possible that their knowledge that wild animals would be attracted to the sweeter grasses of newly burned tracts, may have led to the intentional burning of certain districts, but there is no need to call in this partial explanation. No Indian would ever attempt to check the ravages of fires accidentally allowed to escape, or prevent them from plunging into the

forest. Every one knows that this is constantly occurring in the camps of civilized men, who are responsible for the fact that in the regions over which they have displaced the Indian for nearly a century no growth of timber has yet been allowed to spring up as is its natural tendency. How much less, then, would savages restrain the agency of fire in reducing the forests of the Missouri and Mississippi Valleys to the treeless condition of the plains!

The prevailing winds throughout the entire section under consideration are from the west, and it is easy to see how, in a few centuries at least, the prairies of Kansas, Nebraska, Iowa, Missouri and Illinois might have resulted from this continuous holocaust of their pristine forests.

The very simplicity of scientific truths is often a bar to their acceptance, but science, as Huxley has said, is only common sense methodized and extended. Certain investigators seem to suppose that unless their labors succeed in bringing out some unexpected result no progress has been made. No problem has been more completely in the hands of this class than that of the timberless regions of North America.

This form of sensational science should be discountenanced as tending to warp the candid judgment of students of nature, and to divert them from the one sole aim of science, the discovery of truth.

If, therefore, in considering the facts from which the causes of the absence of arborescent vegetation upon the great plains must be deduced, I have reached a somewhat plain and commonplace conclusion, my only apology must be that no other conclusion has seemed to me to be warranted by those facts.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

Highest barometer during month 29.57, on the 22d. Lowest barometer during month 28.45, on the 26th.

Highest temperature during month 72°, on the 12th. Lowest temperature during month 10°, on the 30th.

Highest velocity of wind during month 46, on the 26th. Total travel, 12,473 miles.

Thunder-storm on the 18th.

The usual summary by decades is given below.

Temperature of the Air.	Jan. 20th to Jan. 31st.	Feb. 1st to 10th.	Feb. 10th to 20th.	Mean.
Min. and Max. Averages.				
Min	18.0	21.0	25.6	21.5
Max	40.0	49.1	56.0	48.7
Min. and Max	29.0	35.0	40.8	34.9
Range	22.0	28.1	30.4	23.5
Tri-Daily Observations.				
7 a. m.	26.0	29.9	33.4	29.8
2 p. m.	36.3	51.1	47.9	43.1
9 p. m.	29.9	39.2	36.8	35.3
Mean	30.7	39.6	38.7	39.7
Relative Humidity.				
7. a. m.	.87	.86	.86	.86
2 p. m.	.82	.66	.65	.71
9 p. m.	.82	.80	.64	.75
Mean	.84	.77	.72	.77
Pressure as Observed.				
7 a. m.	29.02	28.94	28.93	28.96
2 p. m.	29.00	28.90	28.87	28.92
9 p. m.	29.02	28.91	28.92	28.95
Mean	29.01	28.92	28.90	28.94
Miles per Hour of Wind.				
7 a. m.	15.5	10.5	11.8	12.6
2 p. m.	21.3	19.5	22.7	21.1
9 p. m.	13.0	14.1	18.7	15.3
Total miles	4296	3254	4923	12473
Clouding by Tenths.				
7 a. m.	6.5	1.8	6.8	5.0
2 p. m.	6.0	1.7	5.8	4.5
9 p. m.	3.0	1.0	5.3	3.1
Rain.				
Inches	.10	——	.12	.13

JAPANESE METEOROLOGY.

BY ARAI YOSHINARI.

Ideas About the Heavens and the Earth.—It is a very easy thing to ook up into the heaven, but it is unlimitedly high. It is also a very easy thing o touch the earth, but it is unlimitedly thick. We can not go into the heaven ıor can we go down into the earth. For reasons like these, there had been no stronomical instruments (observations?) for many years after the creation. They vere afterward invented in the country called Jutania, in Europe. In China, ıe reason of the eclipse was not explained until after many centuries, but in ıe eighteenth year of Shigen in Gen (the name of ancient China), that is, 1281, .. D., it was understood clearly. Some astronomers have given their opinions bout the motion of the earth, and some have given their opinions about the motions in the heavens. And the opinions about the rain or the wind, etc., all rest n the explanation of the male and female, or active and passive principles of ıture. The rain is a changed form of the male principle of nature and the

vapour under the earth is a changed form of the female principle. When the male principal sinks down into the earth it would pursue the female. The earth is the mother of all things and produces many things, but the heaven is but the air or wind where the sun, the moon, and the stars hang shining. The air is divided into two kinds. One is called the heaven-air and the other is called the earth-air. The motion of the heaven is contrary to the running of water. The heaven turns round from the east to the west, but the water runs from west to east. The running of water is different with regard to the elevation of local districts. In some districts, where the northern part is low, the water under the earth runs in a northern direction, but when it is obstructed by the earth-air which comes from the north it is greatly agitated and commences to evaporate out of the surface of the earth. This vapour goes up into the air and is changed to the rain by the wind. The water has periods of increase and decrease according to the male and female seations. It is increased during the summer months because it is then the male season, and it is diminished during the winter months because it is then the female season.

When the earth-air goes from east to west it is changed to rain, although it is not always so with regard to the temperature of the seasons. Therefore, previous to rain, white vapor is seen, in the morning, rising up in the east. This is a clear proof of the earth's growing hot. It is for the same reason that the mountains become somewhat darker than usual, previous to rain, because vapour is sent up from the earth. In the district which slopes gradually toward the east, the earth-air passes through the earth from east to west, and a sound or smell is produced in the earth, as if coming from east to west.

On the 17th day of the fifteenth month of the ninth year of Bunkwa (181 A. D.) it was very dark weather and hailed greatly but without thunder. This is an unusual occurrence. The thunder is produced by the intercourse of the male and female principles of nature. In the neighborhood of Asamayama in Shinshiu and other volcanoes, on the day of thunder, sounds are heard underground. This is due to the irritation of the earth-air, by which flames are sometimes sent out. It is said that a kind of beast accompanies the thunder and it runs about in the air. It is nothing strange, because it is said that in the island called Ampon which belongs to the country called Darunada, distant 3,900 from Japan, there are birds called Kasubara which are covered with fur-skin instead of feathers; these eat fire; others feed on wind. As this world is unlimitedly great and extensive there may have lived strange beasts or birds, like the thunder-beast which we talk about.

The sound of thunder is just like that of a gun. The sound is heard after the lightning. When the quantity of water-clouds are very small in the heaven sound of the thunder is also very small and is heard as if it were very far off, but when the water-clouds are heaped up very much the sound and the lightning occur together. People should be afraid of the lightning but not of the sound because it comes after the lightning. The thunder is the sound of the fire which is produced at the time when it passes through the water-clouds in the heaven

When this sound passes through the clounds with great power it is said to be a quick, great, and dangerous kind of thunder; but when it goes through very slowly it is of a weak and small kind. The ancients thought that thunder was the fighting between the water and the fire in the heaven, with regard to the rule of the male and female principles of nature, but this is very doubtful. If it were the fighting of the water and the fire, there is no reason for there being a space of time between the first thunder and the next. As it is wrought by the currency of the wind and thickness of the clouds through which the thunder passes, there may be the different sounds and spaces of time. The earthquake is but little different from the thunder. In the time of the earthquake, some sound is to be heard underground previous to it, because it is caused by the water in the inside of the earth, which was compressed for a long time by the earth-air, beginning to run forth.

The wind is said, by the ancients, to be the air which is produced from the sea or mountain. This world has always wind, but there is no strong wind unless it comes from the sea or mountains. The wind is of two kinds. One, or the upper wind, runs southward and the other or lower wind runs northward. The former comes from some mountains or the sea, and the latter is caused by the earth-air. The snow is the vapour which rises up from the earth. When the vapour which has risen up from the earth becomes frozen by the cold it falls on the surface of the earth again in the form of snow. Fog is also vapour from the earth. Haze is the vapour which has been mixed with smoke produced by some volcano. The frost is the frozen vapour sent up from the earth. Hail is sent from some mountains at certain seasons and falls on some parts of the earth. It does not fall on a great area.—*Japan Gazette.*

ENGINEERING.

THE IMPROVEMENT OF THE MISSISSIPPI RIVER.

A discussion is now going on before the House Committee on Levees and Improvements of the Mississippi River, the subject being the best method of preventing annual overflows and preserving a sufficient depth of water in the channel for large vessels.

The Levee Commission propose to continue the system recommended by the Board of Engineers of 1875, which requires levees to be raised at Cairo to the height of three feet, at Memphis and Helena seven feet, at Island No. 71 ten feet, at Lake Providence eleven feet, at Vicksburg and Natchez six feet, at the mouth of Red River seven feet, at Baton Rouge, Plaquemines and Donaldsonville five feet, at New Orleans four and a half feet. This work is proposed to be

done at a cost of about $100,000,000. The River Commission propose to close the outlets, and if they do they will re-establish the levee system recommended in 1875. They claim that the velocity of the stream must be maintained or shoals will be formed from the deposition of sediment at all points where the diminution is felt, and that the adoption of the "outlet system" will inevitably result in the formation of shoals below every outlet, while the construction of levees will confine the stream and thus keep up the velocity necessary to retain the earth and sand in suspension until the Gulf is reached. It is further claimed by the advocates of the levee plan that the best engineers of the country have repeatedly rejected the outlet plan.

The friends of the outlet system propose to open a channel *via* Lake Borgne into the Gulf, through which the surplus water of freshets will find its way instead of overflowing and devastating the adjacent country. Captain Cowdon, of New Orleans, in speaking before the Committee explained this plan as follows: "We leave the river ten miles below New Orleans with a fall of about fourteen feet in going to the lake, a distance of five miles. This lake is about forty five miles long, and has an area of some 300 square miles, and has a central depth of ten or twelve feet, and is a part of the Gulf of Mexico. To make this outlet we propose first to build two levees about a mile apart, one above and one below the outlet, running back from the bank of the river to the bank of the lake, to prevent the overflow of the plantations, above and below, in the rear. Then we have to clear off the timber and do some excavating. This can be done in about sixty days, and if the appropriation can be made in time, we can make the outlet this spring, so as to test it thoroughly and satisfy the whole country and Congress of the truth of what I say."

For this experiment only $250,000 is asked, and in support of the theory he further pointed out the usefulness of the outlets of the Atchafalaya, Morganza and Bonnet Carre in the floods of 1845 and 1877, when the water was higher at all points above than below them. He also claimed that since the narrowing of the river bed, by the construction of the jetties, the water had risen to a greater height at New Orleans and other points on the lower Mississippi than before.

There is also a practical illustration of the value of the outlet system and a practical reply to one of the principal objections of the Levee Commission in the fact stated that, while the outlets of the Mississippi have kept the river in its banks, the river has deepened its own bed from three to four feet from Greenville to the mouth of the Red River, a distance of 300 miles.

Captain T. P. Leathers, an old steamboat man, also made a statement to the committee, favoring the outlet system. Among other things he stated that the levee system was commenced above Red River, at Concordia, Tensas and Madison Parishes, by leveeing the low places and constructing small levees on the high banks. The levees were continued during a period of twenty-one years until 1857, and had pretty well controlled the water in that beat. In 1857, in low water, the water went eighteen inches lower by the bank than in 1836, but the lowest water we had was eight and one-half to nine feet. It showed a deepening of the water

by concentration in that section about four and a half to five feet. He thinks that the only way, and the quickest way, to relieve the country is to concentrate, to keep the water within its banks; and the outlet is the only plan that is possible to obtain the result, the mouth of the river being stopped up; as it is certain that not more than two-thirds of the water goes out now that went out of it eight years ago. It would be impossible to levee the river so as to protect the banks without giving the river an outlet.

The question at issue between the advocates of the two plans is whether the constriction of the channel of the river by the levees and the consequent slacking and backing up of the current will have a more deleterious effect than the checking of the rapidity of the flow below the outlets. We are not certain that the result in either case is correctly stated. If in both, the deposition of sediment would be similar in each case. If, however, as the engineers claim, the velocity of the current is increased by confining the water within its banks, the danger of its cutting the banks and levees during freshets will be largely increased, while on the other hand if the current below the outlet is liable to become in any degree less swift, it need only be so during high water, when great velocity is objectionable rather than otherwise; for if we understand the Cowdon idea it is simply to make use of this outlet in times of freshets and floods, as a safety-valve, so to speak.

The Atchafalaya River, or Bayou, has been found of immense advantage in relieving both the Red River and Mississippi in times of floods, and at this very time Senator Kellogg is asking a large appropriation for deepening it. The Commission, in speaking of the non-conformity of the Atchafalaya to their theory, say, "That the Atchafalaya remained so long unaltered, and is now evidently enlarging, is owing to important changes in the bed of the Mississippi near it, by which a large portion of the floods of the Red River have recently been discharged through it." The Commission made no recommendation regarding the Atchafalaya outlet except such work as is necessary to prevent its enlargement. Captain Suter, one of the Commission, has recently expressed himself favorable to a plan which will cut off the floods from tributary streams.

So far as we can see, this is precisely what the Cowdon plan proposes, viz: to create an outlet which will let off surplus water and of course control it to prevent detriment either to the country adjacent to and at the mouth of the outlet, or in the channel of the river below it. If a lock can be established and worked at Plaquimine, why cannot adequate engineering devices be conscructed to control the outflow at the Lake Borgne outlet? If works can be put in to prevent the enlargement of the Atchafalaya, why not along the course of the Lake Borgne outlet.

As to the "sub-delta" bugaboo, it is an old cry. The same engineers who oppose the outlet plan opposed the jetty plan, and on the same or similar grounds. A "sub-delta" would form at the extremity of the jetties and would continue to form there, no matter how far they were extended, but such has not proved to be the result. The whole question is confined to the possibility and feasibility of letting off the *surplus* water and retaining the *amount necessary* for navigation

and carrying off the sediment. If this problem is insoluble, then the outlet plan is chimerical, otherwise it is sensible and practical.

Theoretically, the engineers may seem to have the best of it, but if actual experience shows the facts to be as stated by Captains Cowdon and Leathers, then the discussion ends and the choice lies with the least expensive and quickest plan. If it succeeds, millions will be saved to the government and it will take but a short time and a moderate sum to find it out. It cannot be a total failure, at the worst, as the experiment at Cubitt's Gap some twenty years ago has shown; and the probabilities are that with the improvements in modern engineering it will be a success. At all events, it will be many years before Lake Borgne can be filled up, and in the mean time Congress will be enabled to render some adequate relief to the Upper Mississippi and the Missouri, which cannot be expected should the levee system be continued at the vast expense required. Even with this object alone in view the bill introduced by Hon. R. T. VanHorn is a wise one and one calculated to be of infinite service to the people of the New West.

SCIENTIFIC MISCELLANY.

THE SCIENTISTS OF COLORADO.

BY MRS. FLORA ELLICE STEVENS.

The State of Colorado is admirably adapted for a general, broadcast scientific knowledge, boys and girls who do not know a Greek verb, and cannot construe a Latin sentence, talk familiarly and yet intelligently of "stamp mills," smelters, or concentrators; of galena, and know a granite formation wherever they see it, though doubtless this knowledge is in an inverse ratio to Mr. Louis Agassiz' neat conclusion upon scholars; these study nature in the open air, and in books they cannot find her. You may trip them up with learned terms, but they know that a difference exists between the rocks of Morrison and of the Garden of the Gods; and again, between these and those in the mountains of Georgetown, and they will stubbornly hold to it. So I repeat that it is a State of rare popular advantages for the growth of scientific thought.

Geology and mineralogy hold the leading places, but chemistry and philosophy are necessarily integral parts of their practical study. However, in this way it will be understood that most of the attention of scientists in this State is directed to those two divisions.

As well known a scientist as there is in the State, by reason of his researches in various fields and his sound and vivid observations, is Capt. E. L. Berthoud of Golden. An old army officer, he has been connected with the School of Mines

and Jarvis Hall, and with the C. C. R. R.; is perhaps the finest engineer in the State; while of the different branches of scientific research into which he

"Dips deep down, and brings the hidden waters up,"

his articles in the REVIEW are much better evidences than anything I could say beyond them.

Professor—now Senator—N. P. Hill has done a wonderful amount toward the development of his State, the success of his endeavors culminating in the works at Argo, two miles east of Denver. These are a combination of smelting, lixiviation and reduction. There is but one other such in the world, that at Swansea, Wales; and before these were built hundreds of thousands of tons of ores were yearly sent to Wales from this part of the country for treatment. The superintendent at Argo is a son of the superintendent at Swansea, and was induced by Senator Hill to accompany him to this country. The works are a wonderful reflection of the labor, time and study spent in their erection by the Senator. It may be added that he is on the senate committee upon the Smithsonian Institution; a pleasant recognition of his services to science.

Professor Richard Pearse, the metallurgist at Argo, is one of the leading men in that department in the State. He has made many valuable improvements upon the Swansea methods of refining and separating the copper matte so as to adjust it to Colorado ores. It may be proper here to state that the works were first located at Black Hawk by the old Boston and Colorado Smelting Company, but removed by Messrs. Hill and Pearse to Argo, because of its better facilities for obtaining fuel.

Prof. J. Alden Smith, the present State Geologist, is the one to whom Boulder County is very largely indebted for the discovery of telluride ores in supposed valueless rock in that district, which gave a lasting impetus to the mining interests of that county. His opinions are marked and valuable, and it is but a slight reward of his services that he received his present appointment from the Governor.

To the Episcopal Church and the late Bishop Randall, Colorado owes several of her scientists. Among those induced to come to Colorado through their means were Rev. E. L. Greene, quite well known as a botanist, now removed to California; Prof. and Rev. Arthur Lakes, an enthusiastic geologist, and Prof. E. J. Mallett, a chemist.

Prof. Lakes, who had classes at the School of Mines and Jarvis Hall, was an excellent teacher, as well as collector, and indefatigable in exploring the regions near and far that promised anything of interest. I have a pleasant memory of him when I was a school-girl. Our class in geology were having a day's excursion to Morrison, and the kindly Professor hearing of it, rode over from Golden to show us some of the interesting points thereabouts, though he did not reach home until midnight in consequence.

Mr. Mallett, who is a son of General Mallett, late consul at Florence, was for a while Professor of Chemistry at Wolfe and Jarvis Halls. Later he has

built the Mallett reduction works at Cañon, which have been fairly successful. He has been a contributor to several scientific magazines as well.

Just at this time an old gentleman, Prof. Waitz, of Rosita, is doing some work that is attracting much attention. It is a process for separating low-grade ores and saving much of the ore that has hitherto been wasted. If the experiment succeeds, it will be of incalculable value to Custer, Fremont and some of the low-grade counties. And at any rate he deserves notice for the labor and experiments he has put upon his scheme.

These are but few of the scientists of the State of Colorado; to name them all, and their works, would be beyond the scope of a magazine article and beyond my powers as a delineator. As I said in the commencement of this article, the majority are metallurgists; I do not remember of any leading astronomers or meteorologists, other than those connected with the Signal Service at Denver and Pike's Peak.

The Hayden survey gave an additional impetus to the cause of science in the State; and the State Historical Association encourages it in its limited way, for it is not very large or old. A hall in the larger places might be secured, and courses of free lectures given with great profit; and more copies of the REVIEW, and journals of its class, taken throughout the State than are now. But Colorado is young and we may hope much for her.

The intelligent women of the State have sustained a loss in the death of Mrs. M. A. Maxwell, whose interesting exhibit of birds and animals at the Centennial is vivid in the minds of many who admired her for her devotion to the cause of science and the difficulties under which she labored. She made for herself an honest fame; and not her sex alone, but all who had heard of her skill, feel that her loss is a grave one.

A CHRYSALIS.

BY T. BERRY SMITH.

Only a chrysalis!
A seeming lifeless thing—a pulseless form!
No beauty there, you say; no current warm
Goes bounding on with swift vivific charm!
Is it only this?
A broken case wherein life used to thrill—
An empty cask no longer fit to fill—
Or does it hold a being living still?
Await a while and see.
And while we wait a change advancing fast,
We'll hie away and treat the wondrous past;
In memory's realms voluminously vast
We'll find out what it be.

Last year a worm went crawling o'er the earth—
A lowly creature sprung of humble birth;
No flitting bird in all its warbling mirth
Espied it crawling round.
In autumn time when summer days were gone
And nature's garb was growing sear and wan,
Among the leaves that strewed the grassy lawn,
One day, by chance 'twas found.

'Twas snatched away from winter's icy whelm,
Put in a cup among some leaves of elm,
And there it spun a soft and silky film
Bewrought with wondrous skill;
The silken warp was threaded round its form—
The filling weft was woven close and warm;
And, lost to sight, secured from every storm,
'Tis resting calmly still.

And since the time it passed from human sight,
Has intervened full many a cheerless night,
And winter's train with bleak, relentless might,
All nature 'round has swayed;
And weary months have passed with weary tread,
And living frames have hungered after bread;
While dirges sad the wintry winds have said
Or wildest chants have played.

The weary while with all its storms and tears
Has brought this worm no racking pain, no fears;
Do sleep the dead thro' all their slumbering years
Unmindful of the time?
But now the spring, with sunlight mild and warm,
Will wake to life this seeming pulseless form:
Just so will rouse the Resurrection morn
The dead of every clime.

Two months I watched to see the bursting strange;
I thought to view the great and wondrous change—
The coming forth the vernal earth to range
Of that inswaddled worm;
But all the spring with its vivific hours
And twittering birds, its bursting buds, its flowers,
Had passed away, nor 'vailed its mighty powers
To rouse the slumbering germ.

The summer came—the lovely month of June—
When midnight choirs sing carols to the moon—
When stillest hours are at the sultry noon,
And shade is in demand;
Still nothing came aforth the sombre shell
Wherein I'd thought some being slumbered well;
But still I hoped the hope I could not quell—
To see the bursting grand.

I hoped to see it ope' its winding sheet
Wherein its rest had been so long and sweet,
And coming forth from that drear, lone retreat
To light of open day,
To quit the frame it once had suffered in
And take a form my pleased gaze to win,
Then spread its wings of gorgeous hues and thin
And lightly soar away.

But all in vain. One day I went abroad,
Knew other scenes and other pathways trod,
Looked on the sun and saw the dripping cloud
Regladden all the earth;
Then when again to my accustomed place
I came and met with many a smiling face,
I also found my long beguarded case
Had given beauteous birth.

The silken tomb was rent and empty found,
No winding sheet now wrapt the pupa round;
The coffined form had felt its spirits bound
And burst its prison shroud;
I found at hand a large and splendid moth,*
Akin to that which weaves our finest cloth,
Whose wings were broad, nor made for moping sloth
But wanderings far and proud.

'Twas able now to wing the realms of air
Where skies were bright and landscapes broad and fair,
To gather sweets from blossoms fresh and rare,
And hither fly and yon;
Its home could be the airy fields of space,
Nor was it bound to any scene or place,
But, borne by wings as delicate as lace,
Could flit it on and on.

* Polyphemus, or American Silk-Worm Moth.

* * * * * * * * * * * *

So men have tried to tell the awful hour
When Christ the Lord would come with waking power
And rouse the dead from every dell and bower
To everlasting life;
They've thought to see the slumb'ring tribes of death,
Who, long or brief, have lain the earth beneath,
Arise and take their new undying breath
With flame immortal rife.

But after all, when no one thinks it near,
The judgment trump will sound its clarion clear,
And sleeping ones will all the summons hear
And leave their dreary clod;
Ignoble bonds will burst to loosen out
A glorious form with pinions new and stout,
Which swift will fly with glad triumphant shout
Thro' fields of space to God.

NEW INSECTS INJURIOUS TO AGRICULTURE.

Almost every year the appearance of some insect or insects injurious to agriculture, but previously unknown in an injurious capacity, has to be recorded. The present year (1881) has afforded several striking examples, as *Crambus vulgivagellus*, which has seriously injured pastures, *Phytonomus punctatus*, which has proved destructive to clover in the State of New York.

A new Pyralid has also very generally ravaged the corn plants in the Southern States. These new destructive species may either be (1), recently introduced species from some foreign country; (2), native species hitherto unobserved, or unrecorded, and new in the sense of not being described; (3), native species well known to entomologists, but not previously recorded as injurious.

The author argues that in the two last categories, more particularly, we frequently have to deal with newly acquired habits, and in the second category with newly acquired characters that in many cases systematists would consider of specific value. In short, he believes, that certain individuals of a species that has hitherto fed in obscurity on some wild plant may take to feeding on a cultivated plant, and with the change of habit undergo in the course of a few years sufficient change in character to be counted a new species. Increasing and spreading at the rapid rate which the prolificacy of most insects permits, the species finally becomes a pest and necessarily attracts the attention of the farmer. The presumption is that it could not at any previous time have done similar injury without attracting similar attention; in fact, that the habit is newly acquired. The author reasons that just as variation in plant-life is often sudden, as in the

"sport," and that new characters may be perpecuated are thus created, so in insects there are comparatively sudden changes, which, under favoring conditions, are perpetuated. In this way characters which most systematists would consider are specific, originate within periods that are very brief compared to those which evolutionists believe to be necessary for the differentiation of specific forms among the higher animals.—*American Naturalist.*

BOOK NOTICES.

Suicide. By James J. O'Dea, M. D.; 12mo. pp. 322. G. P. Putnam's Sons, New York, 1882. For sale by M. H. Dickinson, $1.75.

In this work the subject of suicide is treated partly from a social and partly from a medical standpoint and is divided, generally, into studies of its philosophy, its causes and its prevention. Doctor O'Dea, from his professional position, both in Canada and the United States, is eminently fitted to discuss such a subject intelligently, having been one of the Board of Medical Examiners of Ontario and member of the Medico-Legal and Neurological Societies of New York, etc.

The causes of suicide are divided, generally, into the external or social and the internal or personal; the first again into general and special causes. The general causes exist everywhere and under all circumstances, having their source in extravagant religious and moral beliefs. These are illustrated by six chapters on Religion, Morals and Laws of Antiquity regarding suicide; such as the Doctrine of Continuity, the teachings of Brahmanism, Buddhism, of the Stoics, Epicureans and other schools of Pagan Philosophy; Suicide in Pagan Greece and Rome and among the Jewish people; six chapters on Religion, Morals and Laws of Modern Society, including suicide in the early Christian church, in the middle ages, in modern times; suicide and Roman common and modern law.

Then follows the special and personal order of causes, the first embraced in eight chapters on Age and Sex; Hereditary Influence—Insanity, Imitation; Education—Literature; Domestic Troubles, Love Troubles; Intoxicants, Financial Losses and Embarassments; Race, Nationality; Atmospheric and Climatic Influences.

Among personal causes, he classes bodily causes, mental causes, temperament, and considers the relations of insanity to suicide.

Under the head of Prevention are chapters on prevention by law, by religious and moral training, and by medical advice and treatment. We have thus given the skeleton of the work, and can assure the reader that this skeleton is well built upon and handsomely clothed. While the subject may seem better adapted to the professional than the general reader, its treatment will be found adapted to all intelligent persons who have a taste for historical and philosophical studies.

THE CYCLOPÆDIA OF PRACTICAL QUOTATIONS. By J. K. Hoyt and Anna L. Ward; octavo: pp. 899. I. K. Funk & Co., New York. Cloth, $5.

No recent publication that has come under our observation has given us so much genuine gratification as this. First, on account of the wide range of subjects touched upon, and the extensive list of authors of every age and nationality quoted. Second, on account of the admirable arrangement of the work, and lastly, on account of the remarkable skill displayed in the selection of the quotations themselves. It is one thing to gather together a quantity of ill-assorted and pointless or trite and stale sentences; quite another to select elegant, forcible and adaptable expressions—sparkling gems of thought in brilliant word-settings. In this respect the success of Mr. Hoyt and Miss Ward has been remarkable, which is necessarily due to the fitting combination of talent employed; the practical appreciation of the wants of the literary public by the experienced journalist, and the rare artistic skill of the cultured woman in making, almost by intuition, the proper selections; the business-like laying out of the work by the one, and the untiring, careful, earnest toil of the other.

It far exceeds any work of the kind that has ever been published, in size, scope and availability; no less than 625 double-column pages being devoted to English, Latin, French, German and Spanish quotations; over one thousand authors quoted and their names and nativities given; more than eleven hundred English and Latin subjects referred to, and more than two hundred and forty pages of three columns each filled by an exhaustive concordance, by which every quotation can be instantly found if the reader knows a single leading word of it. Seventeen thousand quotations are included in the work, besides definitions of ecclesiastical and law terms and phrases, etc.

We unhesitatingly recommend it to writers, teachers, students and all others who desire or require a work of reference of the kind, as unequaled and almost unsurpassable.

OPIUM SMOKING IN AMERICA AND CHINA. By H. H. Kane, M. D.; 16mo. pp. 156. G. P. Putnam's Sons, New York. For sale by M. H. Dickinson, price $1.00.

The author, who is also the author of "Drugs that Enslave," asserts that opium smoking is a vice that imperatively demands a careful study at the hands of the American people, from the fact that the practice, comparatively unknown amongst us six years ago, is now indulged in by some six thousand of our countrymen, male and female, whose ranks are being daily recruited; that large and small towns in the west and large cities in the east abound in places where this drug is sold and smoked, and that in some of our States it has become necessary to enact laws for its prevention and suppression.

Dr. Kane's account of the origin and spread of this vice in America is both interesting and startling; commencing in San Francisco, in 1868, and within fourteen years reaching to the above figures and extent, it is enough to alarm

the intelligent and thinking people of the country and arouse them to action. Aside from such statistics there is much information on the early history of opium growth in India; descriptions of opium-smoking places among the English, Americans and Chinese; the effects of the habit on different systems and organs; relative case of cure, mode of treatment; effects of the vice on the individual and on the Nation, etc.

BOOKS FOR ALL TIME.

READING DIARY OF MODERN FICTION. Compiled by F. Leypoldt and Lynds S. Jones: New York, 1882. F. Leypoldt.

These little books are intended as guides to aid in the purchase of books and to kindle a love of good literature. The first is the beginning of a series of catalogues which, when complete, will form an index to the whole field of literature. Those to follow are "The Literature of Knowledge" and "Books for the Young."

The "Reading Diary of Modern Fiction" is intended to present a survey of all that is considered worth reading in the domain of modern fiction. It is interleaved for the convenience of the reader in keeping up with the rapid advance in this department of literature, and will be found very useful in this respect.

Both are well conceived and can be made of great service to readers and book-buyers.

THE FIRST BOOK OF KNOWLEDGE. By Frederick Guthrie, F. R. S.; 12mo. pp. 130. G. P. Putnam's Sons, New York. For sale by M. H. Dickinson, price $1.00.

Notwithstanding some peculiarities of expression and manner, such as calling clay a "stuff" and classing air, fire and water under the general head of "elements," (afterward explained however), this book will be found a very useful one to teachers and scholars. A great deal of ground is gone over and much valuable information condensed in a clear and suggestive style into a small space. Questions to be asked the scholars are placed at the end of each chapter, which is a good feature, either at home or in the school-room. Some of the prominent subjects treated are things and stuffs used for house-building, heating and lighting, finishing and furnishing, clothing, food, writing and printing, etc.

OTHER PUBLICATIONS RECEIVED.

Sensation and Pain, by Chas. Fayette Taylor, M. D.; G. P. Putnam's Sons, 75c. The *Chicago Mining Journal*, edited by Wm. Hosea Ballou, monthly, $1.00. The Religion of all Sensible Men, with four other Sermons, by Rev. David N. Utter, of the Unitarian Church, Kansas City, Mo. The *Omaha Bee*,

annual review for 1881, (illustrated,) a handsome and valuable number. The Gold-Bearing Drift of Indiana, Geo. Sutton, M. D., Aurora, Ind.; pp. 9. The *Home Circle*, a Baptist monthly magazine, published at Philadelphia, Pa.; $1.50 per annum. The *Western Household*, published at Jefferson City, Mo., monthly, by John Meagher; 50c per annum. Atti Della Societa Toseana Di Scienze Naturali, Vol. III, November, 1881. *Manufacturer and Inventor*, Vol. I, No. 3, monthly, New York; $1.00 per annum. Causes of Deafness among School Children and its Influence on Education. Circular No. 5 from Bureau of Education.

EDITORIAL NOTES.

AT the February meeting of the Kansas City Academy of Science, Dr. Joshua Thorne presented a paper entitled "A New Theory of Volcanoes," which was received with interest. It was expected that it would be published in this number of the REVIEW, but as the illustrations could not be prepared in time, its publication was necessarily postponed.

It was determined by the Academy to resume its work as originally laid out, viz: by dividing the membership into appropriate sections, each section to devote itself as far as possible to original investigation. Several new members were elected, after which the meeting was adjourned.

FOR the Warner special prize of $200 for the best essay on comets, their composition, purpose and effect on the earth, 125 essays were sent to Director Swift, of Warner Observatory. The judges, Prof. Elias Colbert, of Chicago, Prof. H. A. Newton, of Yale College, New Haven, Conn., and Prof. H. M. Parkhurst, of New York City, unanimously awarded the prize to the essay written by Prof. Lewis Boss, director of Dudley Observatory, Albany, N. Y.

THE suggestions of Dr. John Fee, City Physician, in his late report to the Mayor and Council, are eminently practical and praiseworthy. Every one of them is based on experience, backed by a thorough knowledge of his profession, and the sooner the city avails itself of them the better it will be for

general editorial supervision of Geo. S. Morris, Ph. D., Professor of Logic, Ethics nd the History of Philosophy in the University of Michigan, and Lecturer on Philosophy at the Johns Hopkins University, Balmore, and with the co-operation of eminent cholars. $1.25 per volume.

the *Manufacturer and Builder*, and the *New York Observer*, all valued exchanges of the REVIEW. The *Scientific American*, while suffering severe loss, saved its account books, records and patent drawings, and, since its printing was done in another building, was enabled to proceed without interruption of its business. Its new offices are located at 261 Broadway, near Warren Street, a very central and convenient location and one that will soon become as well known to the people of the United States as "37 Park Row" has been for the past quarter of a century. We have not learned the new addresses of the other papers mentioned.

PROF. J. D. PARKER, who has frequently contributed to the columns of the REVIEW and who is otherwise well known as an able and scholarly man, has recently taken the position of business manager of the *Mid-Continent*, a religious and literary paper of this city.

WE have received form Judge F. G. Adams, Secretary of the Kansas State Historical Society, at Topeka, a circular requesting its friends to send him for preservation books, pamphlets, old maps, letters, biographical sketches of old settlers, and, in brief, anything that can by the most liberal construction illustrate the history of Kansas, its early settlement, its progress and present condition. Doubtless hundreds of the older citizens of the State can and will aid materially in this matter, which should be one of pride and duty.

PROF. BROADHEAD notifies us of an error in the "Missouri Historical Notes," published last month, on page 630. It should read "Jackson County taken off Lillard in 1826," instead of 1820.

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this department of literature, and will t
Both are well conceived and can
book-buyers.

Harper's Monthly for March is an excellent number. The articles are exceptionally interesting, and the illustrations very fine indeed. Prof. Simon Newcomb contributes an illustrated article entitled "A Small Telescope and What to See With It," which will be found both attractive and instructive. W. H. Bishop continues his "Typical Journeyings and Country Life in Mexico," while the poetry and fiction are fully up to the best magazine standard. The Editor's Department is all that can be asked.

Popular Science Monthly for March was received unusually early this month and is a valuable and entertaining number. In addition to the usual vigorous original and selected articles, the editor has recently introduced a new department entitled, "Entertaining Varieties," which will lend additional attractions to the magazine with ordinary readers.

WHILE other localities, east and west of us, have suffered from cold, our mercury has fallen below freezing but very few times during this winter, and as low as 10° above zero but twice altogether. We have had snow but twice and not more than an inch either time. Very little mud and no high water.

PROF. EDWIN F. SAWYER announces the discovery of a new variable star; Durchmusterung star 1° 3408, a variable of the Algol type with a period of a little less than five and a quarter days, the fluctuations in light being about three-fourths of a magnitude. The decrease to minimum occupies ten to twelve hours, and the increase a like interval of time. During the rest, or four-fifths of the period, it remains at its maximum brilliancy.

THE Kansas City REVIEW OF SCIENCE AND INDUSTRY for February is out with an excellent table of contents. Each successive number of Col. Case's valuable magazine seems better than its immediate predecessor.—*Kansas City Journal.*

BACK NUMBERS WANTED. All persons having spare copies of the REVIEW for June, 1879, or February, 1880, will receive a fair price for them upon returning them to the editor.

MAJ. S. HERSHEL, British engineer and grandson of the famous astronomer, is at Washington. He visits Washington upon invitation of Prof. Hilgard, of the coast and geodetic survey, to take part in certain nice pendulum observations for determining the exact force of gravity at this point. He brings pendulums used in similar experiments in England and India, and which are to be used at various points on the earth's surface to ascertain more precisely the actual formation of the sphere. Tests will be made at the Smithsonian Institution.

THE Royal Geographical Society, of London, has voted an appropriation of £10,000 for Leigh Smith's Arctic Expedition.

THE Kansas City REVIEW OF SCIENCE, edited by Mr. Theo. S. Case, is a credit to Western intelligence and thrift.—*La Cygne Journal.*

THE Kansas City REVIEW OF SCIENCE AND INDUSTRY, edited by Theo. S. Case, M. D., contains much scientific reading. Each of its articles is short enough to be read without weariness at one sitting. Dr. Case is a Marietta graduate and has attained a good reputation in his profession.—*Marietta Register.*

MR. E. E. PHELPS, of M. H. Dickinson's, informs us that he will soon have "Rawlinson's Ancient Egypt," published in two superb volumes, illustrated with maps, 253 fine wood cuts, and nine full-page plates. The work will cover over 1,100 pages. Price $6. The price of the English edition is $21.00, and no better in any respect.

ITEMS FROM PERIODICALS.

THE *Literary World* for December 31, 1881, which we should have noted before, contained a most complete review of the literary productions of the year 1881, throughout the world. The entire number is given up to it, except the last page or two, and the list of works on Art, Biography, Fiction, History, Language, Law, Medicine, Poetry, Science, Travel, etc., is truly wonderful, and evinces great labor. The *Literary World* is now in its 12th volume.

THE *Humboldt Library*, No. 29, contains "Facts and Fictions of Zoölogy," by Andrew Wilson, Ph. D., 65 pages, octavo; 15c.

THE best article on the treatment of the Indians that we have seen is that of William Justin Harsha, in the *North American Review* for March, entitled "Law for the Indians."

CIVIL engineers will be interested in the "Story of the Hoosac Tunnel," meteorologists in that on "Hurricanes," and all naturalists in "Among the Sky-Lines" and "Our Winter Birds," by Mary Treat; all in the

ONE of the most notable books of the day, and one of special interest to scholars, is announced as in preparation by S. C. Griggs & Co., Chicago. It is a translation of Frederic Winkel Horn's "History of the Literature of the Scandinavian North, from the Most Ancient Times to the Present," lately published at Leipsic. The American edition is to be the joint work of the original author and Prof. R. B. Anderson, of the University of Wisconsin. It is the only book in literature covering this field, and is brilliant and attractive as well as exhaustive. It will be an octavo volume of over 500 pages.

They also announce that they will begin, early in the year 1882, the publication of a series of "German Philosophical Classics for English Readers and Students," under the general editorial supervision of Geo. S. Morris, Ph. D., Professor of Logic, Ethics and the History of Philosophy in the University of Michigan, and Lecturer on Philosophy at the Johns Hopkins University, Baltimore, and with the co-operation of eminent scholars. $1.25 per volume.

THE London *Electrical Review* of February 4, reprints the editorial article upon "Underground Cables" copied from the Kansas City *Journal* in the January issue of this magazine. It is a clearly and carefully written description of the processes involved, and is well worthy of this compliment.

THE Sedalia *Register* publishes a very interesting account of Mr. R. A. Blair's explorations near that city and his remarkable discoveries of mastodon bones and remains of other extinct animals. We have examined this collection and regard it as very valuable on account of the perfect condition of most of the specimens, as well as their number and variety.

THE *American Monthly Microscopical Journal*, edited by Romyn Hitchcock, F. R. M. S., at 53 Maiden Lane, New York, is the best journal of its class that comes to our table. We have frequently availed ourselves of articles from its columns to the advantage

KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. V. APRIL, 1882. NO. 12.

PALÆONTOLOGY.

ON THE ORIGIN AND DEVELOPMENT OF THE EXISTING HORSES.

BY JACOB L. WORTMAN.

Within the past few years the fossil deposits of the West have become so noted for their production of fossil remains, that American palæontology must be assigned its appropriate rank, as a leading feature of American science. It is a lamentable fact that our educational institutions, generally good in other respects, are, with few exceptions, little prepared to teach the important results that have been reached in this field of investigation, but content themselves with a presentation of the subject as it appeared fifty years ago. The most reasonable explanation of this lack of interest on their part is probably found in the circumstance that they are ruled by a feeling adverse to the general conclusions favorable to the doctrine of evolution inevitably reached in a study of this branch. This results in the selection of unqualified men to fill the appropriate chairs, and who do not apprehend the true significance of the evidence produced.

The absolute inter-dependence of important questions in biology, as well as the necessity of such knowledge in the general "make-up" of a scientific education, are strong arguments in favor of a more extended study of palæontology.

A complete knowledge of the origin and development of any single form is seldom made out, and I may safely say that it was not until the authors of the Evolution Hypothesis brought forth their arguments to show that existing species

have been developed from pre-existing forms by physical means, that any real progress was made in the solution of this problem. As many of these changes must have occurred in the remote past, it is necessary to know the history of their geologic succession. Palæontology, therefore, affords us the primary basis upon which both advocates and opponents of this theory must rest their opinions and formulate their beliefs. Evidence bearing directly upon the past succession of several groups of the *Mammalia* has of late years been accumulating to such an extent as to render it now possible to construct their phylogeny and discern with a comparative degree of certainty the exact lines through which they have descended to their present condition.

For this purpose I have selected as the subject of this article a member of an order known to naturalists as the *Perissodactyla*, a name derived from two Greek words meaning odd-toed. In defining the systematic position of this animal it will be necessary to discuss the classification of, first, the order to which it belongs, and second, the various sub-divisions included within the order itself. In the pursuit of this course the use of technicalities is unavoidable, but these I will endeavor to make as clear as the circumstances will permit.

As considerable has already been written upon the genealogy of the horse by others, it might appear imprudent for me to say more. But unfortunately the nomenclature that has been used renders it quite impracticable for the palæontologist to ascertain to what forms reference is made. The genera *Eohippus*, *Orohippus*, *Miohippus* and *Pliohippus*, have not, in the author's estimation, been distinguished from genera previously described and figured by other authors; hence my reasons for adopting names more in accordance with the prevailing nomenclature of the science.

The *Perissodactyla* may be defined as mammalian animals having both pairs of limbs fully developed and adapted for walking or running. Toes with terminal phalanges encased in strong corneous sheaths developed as hoofs. But as these characters apply to two other orders also, viz: the "cloven-hoofed" or *Artiodactyla*, and the "short-footed" or *Amblypoda*, it will be necessary to consider the characters that establish the differences between these natural groups. It must be observed that the anatomical features that separate these orders are to be found mainly in the structure of their hind limbs. A comparison with the *Artiodactyla* shows that the hind feet always possess an odd number of toes, while in that order the number is permanently even, as far at least as our present knowledge extends. The third digit of each foot is symmetrical in itself, which is not the case in the *Artiodactyla*. An important bone of the "hock" joint which corresponds to the ankle-bone of man, and to which the name astragalus has been given, presents either a single articular face to the navicular bone below or has, more commonly, a small facet in addition for articulation with the cuboid bone. The femur, or thigh-bone, possesses a strong third trochanter for the insertion of the *gluteus maximus* muscle, a process not found in the corresponding bone of the "split-hoofed" division. The astragalus in the *Artiodactyla* has its inferior surface divided into two subsequal facets, which are very convex antero-posteriorly

and separated by a distinct trochlea or pulley-like depression from before backward, and forming a perfect hinge joint in its articulation with the cuboid and navicular bones respectively. The superior surface of this bone in both these orders is strongly convex fore and aft, and is traversed by a deep groove passing outward and backward which receives a corresponding elevation on the distal face of the tibia.

Another ungulate or hoof-bearing order to which they hold near relationship, has been separated and defined by Prof. E. D. Cope in his Report on Captain Wheeler's Survey West 100th Mer., under the name *Amblypoda*, a term meaning short-footed. They are as yet confined to the Eocene period exclusively, and are found both in Europe and this country. In points of affinity to the hoofed orders generally they occupy a most interesting and important position; being in all probability the oldest, and offering the most generalized condition known among the ungulates. The brain capacity is exceedingly small in relation to the size of the other parts of the skeleton, and from certain casts made from the brain case itself we are warranted in assigning these animals a position among the lowest mammalia; they are lower in brain development even than some of the *Marsupials.* The feet are very short, are provided with five fully developed toes, and have their entire plantar and palmar surfaces applied to the ground, as in the modern bears. The astragalus is greatly flattened from above downward, and is primitive and characteristic. It displays upon its inferior surface flattened articular facets for both navicular and cuboid bones which share the articulation about equally. Upon the superior portion, the surface articulating with the tibia, it is almost flat, a condition which must have rendered the ankle joint capable of very little movement and giving to these animals a peculiarly awkward and shambling gait. It is not difficult to perceive that these small brained five-toed and plantigrade *Amblypoda* could easily have furnished a starting point for both the *Artio* and *Perissodactyla*, and, as we have good reasons to believe, did give origin to the *Proboscidea* or elephants. Figs. 1, 2 and 3 illustrate the difference noticeable in the feet of hind limbs of the three orders. Fig. 1 represents foot of an *Amblypod;* Fig. 2, that of a *Perissodactyle*, and Fig. 3 that of an *Artiodactyle.*

FIG. 1.

Right posterior foot of a species of *Coryphodon*, after Cope; one-half natural size.

From the study of collections recently made by the writer in the lower Eocene beds of Wyoming, Prof. Cope divides the *Perissodactyla* into two sub-orders.

These he calls *Condylarthra* and *Diplarthra*. Their distinctive characters are found in the inferior extremity of the astragalus,—and its manner of articulation with the cuboid and navicular bones. In the former the distal face of the astragalus is convex in every direction, and articulates with the navicular alone, while in the latter this portion of the bone is considerably flattened and unites with both navicular and cuboid, although the surface for the latter is quite small and insignificant in comparison with the former. The *Condylarthra* includes as yet

FIG. 2.

Right posterior foot of ***Protohippns sejunctus*** Cope, from Colorado, about one-half natural size. From Report U. S. Geol. Sur. Terrs. F. V. Hayden, IV.

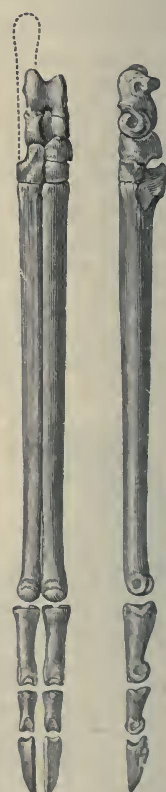


FIG. 3.

Right posterior foot of ***Poebrotherium labiatu*** Cope from Colorado, three-fifths natural size. Fro Hayden's Report, IV, Pl. CXV.

two families, *Phenacodontidæ* and *Menisco theriidæ*, whose remains have bee found so far only in the lower Eocene deposits of this country. It is interes ing to note that they are the most generalized of any known *Perissodactyla*, an supply us with a link long and earnestly sought for in the evolution of th latter and more specialized forms of this order. The feet are considerab shortened and furnished with five toes in functional use upon each, a charact which at once constitutes an approach to the *Amblypoda*. The molar teeth a

of the simple four-lobed pattern, resembling in this respect the suilline *Artiodactyla.*

The *Diplarthra* on the other hand are more numerous, and embrace a much larger number of forms. They are divisible into ten families, including forty-eight genera, variously distributed throughout geologic time. As but four of these families concern us for the present, I will spare the memory of the reader by not discussing the classification of the others.

The first of all to which attention may be directed is the *Lophiodontidæ*, embracing eight well defined genera which are not positively known to have existed later than the upper Eocene epoch. They may be recognized, first, by the possession of four toes upon the anterior and three toes upon the posterior limbs; seccond, by the molar and premolar teeth being different (Fig. 7), and third, by the non-separation of the anterior and posterior external cusps of the superior molars by an external rib-like pillar. The next family is the *Chalicotheriidæ*, to which ten genera are referred. The digital formula is the same as in the *Lophiodontidæ*, as is also the relation of the molar and premolar teeth. The only distinction is found in the separation of the anterior and posterior external lobes by a vertical ridge. The remains of this family range from the lower Eocene to the middle Miocene, inclusive. The third family is the *Palæotheriidæ*, having three toes upon each foot. The molars and premolars are alike and the inferior molars possess perfect double crescents.

The fourth and last family is the existing *Equidæ*, in which the digital formula is reduced to one toe upon each foot. The molars and premolars are alike and highly complex in structure. It is to this family all the existing horses belong, and it has been traced as far back as the upper Miocene strata. The relations in time of these families may be exhibited as follows:

	EOCENE.		MIOCENE.			PLIOCENE.	RECENT.
	LOWER.	UPPER.	LOWER.	MIDDLE.	UPPER.		
Phenacodontidæ.	———						
ontidæ.	———	———					
Chalicotheriidæ.	— —	———	———	———			
Palæotheriidæ.		———	———	———	———	———	
Equidæ.					———	———	———

Having determined then the position that the horses hold in relation to other allied forms, as well as their geologic station, we are now prepared to trace the history of their past succession, and point out the successive steps in modification of structure by which one of the most specialized conditions known among the ungulates has been reached. But before proceeding it may be well to understand just here what is implied by this term specialized and what constitutes specialization in these forms. For the purpose of explanation I introduce a short digression.

Among existing animals in which the teeth possess short crowns with low blunt tubercles on their triturating face, (the bunodont type of dentition) we observe correspondingly simple digestive apparatus assiciated with a short intestinal canal. In other animals, as many of the existing ungulates for example, the crowns of the teeth are greatly lengthened in a vertical direction, uniformly broadened, and the face presents a complex folding of the enamel plates, (the selenodont type of tooth). Here we notice more complicated digestive organs associated with great length of alimentary tube. The relation of these conditions to the character of the food upon which the respective types subsist is obvious. The Bunodonts require condensed and nutritious diet for their support, and are omnivorous, while the Selenodonts are fitted to subsist upon food containing a smaller proportion of the nutritive elements but of which greater quantity is required. The former are as a general rule dwellers in swamps and forests and live upon nuts, berries, and roots, while the latter occupy the open plains and subsist upon the grasses and branches of trees. Now, any influence sufficiently potent to compel the bunodont ungulates to forsake their natural habitat and live in the open field would also entail corresponding modification or extinction. Such we can easily conceive would be the effects of climatic change or greater incursions from carnivorous enemies. Once in the open field, speed would become a desideratum as a condition of safety, hence the foot with a reduced number of digits would possess many advantages over the polydactyle one. Specialization therefore, I conceive to consist in greater and more perfect adaptation to the conditions under which the animal survives.

With these facts in view then we may proceed. Prof. Cope ventured the assertion some years ago* that the quadritubercular or four-lobed bunodont tooth was the archetypal pattern in which all the more specialized selenodont molars had their origin. This proposition may now be regarded as demonstrated, and the passage from this type of tooth to the highly complicated form in the animals under consideration, I will attempt to show, has been close and consecutive, and intimately associated with reduction in digits.

As the *Phenacodontidæ*, Cope, plainly present us with this hypothetical condition both as regards the teeth and the number of digits upon each limb, they cannot be regarded otherwise than as the primitive ancestors of the succeeding members of this important and once populous order. There has been probably no discovery among the ungulates since the finding of the *Amblypoda* that has proved equal in interest and importance to the discovery of this group. The descent of all the ungulates from the *Amblypoda* has been held by Prof. Cope for some time, but that this derivation took place from any known genera of this order, the comparatively specialized condition of the teeth of the latter distinctly forbids. This moderate complexity of the teeth among Eocene mammals is a striking exception especially when associated with such a low grade of organization of other parts as we find in these animals. The explanation of this fact must

* "On the Origin and Homologies of the Types of Molar Teeth of Mamalia Educabilia." Jour. Acad. Sci., Philadelphia, 1874.

in my judgment be sought for, in their large size, and possession of powerful canine teeth which would grant them greater immunity from the attacks of their fierce carnivorous contemporaries. With these means of defense they could take up their abode in pastures where food more congenial to their tastes was furnished; hence we can with perfect consistency look for a rapid modification of these organs accompanied with slight change in others. In order to make the connections complete between them and the Phenacodonts there should yet be found an Amblypod with bunodont molars reduced canines, and a more elongated foot. An approach to this condition as far at least as the molar teeth are concerned is found in a new genus recently described by Prof. Cope under the name *Manteodon* (prophecy tooth). The Phenacodonts present considerable variety of structure as far their anatomy is at present known. Prof. Cope has described five genera. One genus, *Catathlæus*, shows a peculiar sculpturing of the outside of the molar teeth similar to that seen in many reptiles, and is the only mammal known to possess it. In the genus *Anacodon* the molar teeth lack distinct tubercles, a character which assigns it the lowest position in the family. Phenacodus on the other hand approaches nearest to the Lophiodonts in dental characters, and is here taken for illustration. The teeth are forty-four in number, and are disposed as follows: Incisors $\frac{3}{3}-\frac{3}{3}$, Canines $\frac{1}{1}-\frac{1}{1}$, Premolars $\frac{4}{4}-\frac{4}{4}$, Molars $\frac{3}{3}-\frac{3}{3}$. Fig. 4 represents a superior molar of a species of this genus; *ae* is the anterior external, *pe* the posterior external, *ai* the anterior internal and *pi* the posterior internal lobes respectively. They are low, obtuse and constitute the principal cusps of the crown. *acc* and *pcc* are the anterior and posterior cross crests which are rudimentary and represented by isolated tubercles in this animal, but which are developed into important structures in the more specialized genera. *y* is the rudimental external rib separating the antero and postero-external cusps.

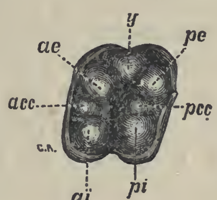


FIG. 4.

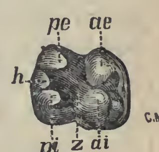


FIG. 5.

Fig. 4.—Left sup. molar of a species of *Phenacodus*. Natural size; *y* is drawn too large. (After Cope).

Fig. 5.—Left inf. molar of same. Natural size. (After Cope.

An antero-basal lobe arising as an outgrowth from the cingulum or ledge surrounding the base of the crown is strongly marked in some genera. In the inferior molars (Fig. 5) the four principal cusps hold the same relation to the crown and are lettered as above. *z* represents a low, indistinctly marked ridge, passing from the postero external to the antero internal cusps *pe ai.* The antero internal cusp *ai* is sometimes double. *h* is the heel which is so strong in the last molar as to be called a fifth lobe. It is connected by a faint ridge with the postero external cusp *pe.*

The feet as already stated possess five toes upon each foot. Fig. 6 exhibits a diagram of a left anterior foot in which the third digit *M iii* is the largest. The second and fourth *M ii* and *M iv* are about equal to each other in size but smaller, while the first and fifth are unequal and still more reduced.

From this group we pass to the lower forms of the *Lophiodontidæ* which appear as contemporaries of the *Phenacodontidæ*. This fact in itself points to a greater antiquity of the Eocene fauna than the Wasatch or lower Eocene epoch.

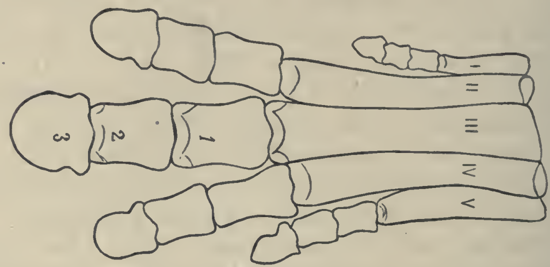


FIG. 6.

Diagram of left posterior foot of *Phenacodus pinnævus*. About one-half natural size.

The sudden appearance of a fauna comparatively high in the scale of organization without announcement in the preceding formation, as is the case with the present, materially affects the belief in gradual transitions. But when we stop to consider that the earliest known appearance of the Mammalia, is in the Triassic rocks, and that in two intervening formations, Cretaceous and Laramie, not a single bone of a Mammal has yet been found, we may confidently look to future discovery for a complete removal of this seeming inconsistency.

[*To be Continued*]

EUROPE BEFORE THE ARRIVAL OF MAN.

BY JOHN FISKE.

* * * * * * *

The most interesting feature of Eocene Europe was the peculiar character of its mammalian fauna. At first we find marsupials, and carnivora with marsupial affinities, showing that the order of carnivora was then only beginning to be evolved. Afterward came such creatures as the *anchitherium*, the ancestor of the horse, in general aspect somewhere between the Shetland pony and a pig, and with three separate hoofs on each foot. There were also the *anoplotheria*, or common ancestral forms of antelopes and deer, as yet without horns or antlers. The highest order of mammals, the Primates,—including man, ape, and lemur,—was then represented by the *adapis* of the Paris basin, the *necrolemur* of southern France, and the *cænopithecus* of Switzerland. Now none of these Eocene primates answered to any living genus of lemur, though the lemurs are the least specialized of primates now existing ; but all these Eocene primates showed signs of relationship, in one way or another, to the hoofed quadrupeds living at that time, which, as we must not forget, were only on the way toward becoming hoofed quadrupeds such as we know. Cousinship, however remote, between

such extremely specialized creatures as the horse and his rider seems odd to think of; yet the lemuroids of the Eocene furnish the link. And it is interesting to remember that, owing to the closeness of relationship, the lemuroid *adapis* was actually mistaken by Cuvier for an *anoplotherium*, or primitive antelope-deer. Of all anatomical contrasts, what can be greater than the contrast between a solid hoof and the flexible five-fingered hand of a Rubinstein? Yet the Eocene great-uncle of our modern pianists could be mistaken for his contemporary great-uncle or great-grandfather of our hoofed quadrupeds! And this instance is but one fair sample out of many of the changes which the last five or six or eight million years have wrought.

Speaking generally, it may be said that in the Eocene age there were carnivora, and there were ungulata, and there were primates; but these orders were not so clearly distinguished from each other as they are to-day, and they are not so clearly distinguished from other orders, such as the rodents and insectivora, while in many cases they had not ceased to bear the marks of their marsupial ancestry. Or, to put the case in another way, in the Eocene peri d you have an instance of hoofed quadrupeds, but you don't find an instance of any such special form as horse or deer or camel; you find carnivora, but you don't find a c'ear instance of *felis* or *canis* or *ursus*,—not even of hyæna, an earlier type than either of the others; and you find primates, but among these there is nothing yet so clearly distinguished as a monkey. In short, the present *species* or *genera* of mammals had not come into existence in the Eocene period, but only the present *orders* and some of the present *families*; and even the orders were not clearly distinct from one another, as they are at present; but they were closely interlocked, very much as species are at present. In other words, the whole class of mammals in the Eocene age was far less highly specialized than it is at the present time.

From these premises Mr. Boyd Dawkins argues, with convincing force, that man could not possibly have existed in Europe, and probably nowhere on the earth, during the Eocene period.

At a time when the order of ungulates had not clearly developed the distinction between camels and pigs and horses, and when the order of primates was only just beginning to be distinguished from other orders, so that Cuvier could even mistake a primate for an ungulate,—at such a time was it at all likely that man, the most highly specialized of all primates, or of all animals, could have existed? Obviously, he could not have existed at such a time. The supposition is absurd on the face of it. As Mr. Boyd Dawkins says, "to seek for highly specialized man in a fauna where no living genus of placental mammal was present would be an idle and hopeless quest."

Coming to the Miocene age, we find traces of extensive submergencies of parts of the European continent, followed by re-elevations. Considerable portions of Gaul and Italy were laid under water, and at one time the whole basin of the Danube was covered by a sea which connected with the Mediterranean near Berne, thus reducing Switzerland and Italy to an archipelago. The Alps,

however, seem to have maintained a relative height as great as that of to-day, in comparison with the lands about them. The elevated position which Britain had occupied in the Eocene age seems to have been kept up during the Miocene. The whole of Britain a-d Ireland, with the English and Irish channels, the German Ocean, and the Atlantic ridge between Scotland and Greenland, stood at at an average of nearly 3000 feet higher than they do to-day, so that the whole region remained dry land, and Gaul as still joined in this way to Scandinavia and North America.

Above this high level the Scottish Highlands and the Welsh peaks rose to a height of some 7,000 feet, having since been worn down to half that height by rain and ice. Many of these great mountains, thus standing nearly as high above sea-level as the Alps, were active volcanoes; and this chain of volcanoes, of which Hecla is now the most famous remnant, extended across the Atlantic ridge, all the way from Wales to Greenland, which was then covered with a luxuriant vegetation of oaks and chestnuts, vines and magnolias. In the earlier part of the Miocene age the general climate of Europe resembled that of Algiers or Louisiana at the present day, but at the close of the period it had become somewhat cooler, though still subtropical Gigantic conifers, like the famous trees of California, 400 feet in height and 25 or more in thickness, flourished all over Europe, from Italy to Norway. Along with these there were cycads, fan-palms, palmettos, figs, laurels and myrtles, poplars, lindens and maples, acacias and elms, camphors and cinnamons and sandalwood; while ivies and bignonias grew in luxuriance. Cranes, flamingos, and pelicans were common, as also geese, herons, pheasants, paroquets, and eagles. But the mammals, in this as in the preceding epoch, present the most instructive subject of study. Opossums were still present, but had vanished before the middle of the period; and a few existing genera of placental mammals had come upon the scene. There were tapirs and small rhinoceroses, as well as squirrels, moles, and hedgehogs, and carnivores similar to the weasels and civets. Collateral ancestors of the deer and antelope roamed about in large herds, and by the middle of the period had begun to acquire small horns and antlers. In mid-Miocene times the anchitheres disappeared, and were succeeded by the hipparion, much nearer in structrue to the horse. The mastodon came in about the same time, and with him another elephant-like creature, the deinotherium, who lived in the water like a hippopotamus. Carnivores of the cat family reached their highest point of development as regards size and power in the middle and upper Miocene: the machairodus, or sabre-toothed lion, was much larger and more formidable than any lion or tiger now existing. The same period witnessed the arrival in Europe of true apes and baboons, and even of two species of anthropoid ape, allied to the gibbons, one of which, the dryopithecus, was as large as a man, and has been regarded as in some respects superior to any modern anthropoid ape.

Mr. Boyd Dawkins—to whose admirable treatise on Early Man in Britain, the present article is under great obligations—argues forcibly against the probability that man occupied Europe during any part of the Miocene period. All the

species of Miocene land mammals, and several of the genera, are now extinct: and Mr. Dawkins urges that if man existed at that remote period it is incredible that he alone should have subsisted unchanged amid the destruction or metamorphosis of all other species. But it seems to me that Mr. Dawkins partly answers this argument himself when he observes that, "were any man-like animal living in the Miocene age he might reasonably be expected to be not man, but intermediate between man and something else, and to bear the same relation to ourselves as the Miocene apes, such as the mesopithecus, bear to those now living, such as the semnopithecus." Why may not such a semi-human man have existed in the Miocene age, the race having undergone since then changes parallel to those which have affected the apes, or to those which have affected generally such Miocene genera as have survived down to our times? No remains of any such creature have been found, but it is indisputable that artificially chipped flints and the artificially cut rib of an extinct species of manatee have been discovered in mid-Miocene strata in France. Mr. Dawkins is inclined to adopt M. Gaudry's suggestion that the flints may have been chipped and the rib cut by the great man-like ape, the dryopithecus; for although it is not known that any existing apes are in the habit of chipping flints or cutting bones, yet it is not impossible that the dryopithecus may have somewhat surpassed the present apes in intelligence. On the other hand, M. de Mortillet regards these relics as conclusive proof of the existence of man in mid-Miocene Gaul. The question can hardly be decided at present.

But it does not seem to me that Mr. Dawkins' line of argument, which is so conclusive when applied to the Eocene age, is equally conclusive when applied to the Miocene. At an epoch when there were no true apes as yet to be found, when even the lemurs bore marks of kinship with the ancestors of ruminants and pachyderms, and when the carnivorous type was but half developed, it would clearly be idle to expect to find traces of man. But at an epoch when many modern genera had come into existence in all the principal orders, and when in particular there existed an ape as high, or higher, in organization than the modern chimpanzee or gorilla, I can see no such overwhelming improbability of the existence of man himself. No doubt, however, if the remains of Miocene man are ever to be found, they will disclose a type of humanity quite different from, and very likely much lower than, any that we now know. It is not at all improbable that such remains will by and by be discovered in some part of the earth, if not in Europe. By the time the strata of Africa have been explored with anything like the minuteness with which those of France and England have been examined, we shall be very likely to meet with clear indications of the former presence of half-human man, and it will not be strange if such indications lead us far back into the Miocene epoch.

In the Pliocene period the geographical structure of Europe began to be much more like what it is to-day. Hitherto, during the greater part of the Tertiary epoch, large portions of Russia and Siberia had been submerged, so that the continent of Asia did not extend nearly so far north as at present. A belt of

sea appears to have stretched from the eastern Baltic across to the Persian Gulf, including the areas of the Black and Caspian seas; and another wide channel seems to have run west of the Ural Mountains, connecting the Caspian area with the Arctic Ocean, so that the warm waters of the Indian Ocean found a free passage to the very shores of Finland and Scandinavia. According to Prof. Archibald Geikie, these shallow seas disappeared early in Pliocene times, leaving the Aral, Caspian, and Black Seas in something like their present isolation. While eastern Europe thus began to acquire its present contour, equally remarkable changes occurred at the same time in the west. The Atlantic ridge between Britain and Greenland was submerged, thus separating Europe from America, and the connections of Norway with Spitzbergen on the one hand and Scotland on the other were also severed by the encroachments of the North Sea. But the British Islands were still joined to each other and to the Gaulish mainland; the whole of Britain jutting out from the continent as a great triangular peninsula, with the Shetlands in its apex. The volcanoes of northwest Britain gradually lost their fires during the Pliocene age. Icebergs appeared in the North Sea, and the general climate of Europe, though still milder than to-day, was much colder than it had been during the Eocene and Miocene epochs. The vegetation began to lose its subtropical aspect. Bamboos, evergreen oaks, and magnolias still mingled with maples, willows, and poplars in the latitude of Lyons, but the cinnamon-trees and palms became restricted to Italy. Among mammalia, the first species that has continued to live down to the present time, namely, the African hippopotamus, appears in the upper Pliocene strata of Auvergne. The earliest true elephant, though of a species now extinct, appears at about the same time; and contemporary with him were two species of mastodon, of enormous size, a rhinoceros, a tapir, two or more bears, the giant sabre-toothed lion, an ancestor of the panthers and lynxes, and two kinds of hyæna. There were many species of deer, with antlers, but for the most part unlike modern deer. The ox appears first in the upper Pliocene, but without horns. There were also wolves, and swine, and two kinds of ape. The hipparion still lived, but was becoming scarce, and along with him existed a horse, less specialized in teeth and feet than the modern horse.

Now from the fact that of these Pliocene mammals every one has long since become extinct except the hippopotamus, Mr. Dawkins again proceeds to argue that it is not likely that man inhabited Europe at that period. The alleged instances, three in number, of the occurrence of human remains in Pliocene strata of France and Italy he pronounces unsatisfactory; and he does not even mention the brilliant investigations of the Geological Survey of Portugal, which have brought to light flint implements, of undoubted human workmanship, in great abundance in the Pliocene strata of that country, buried under 1200 feet of superincumbent rock. These discoveries, set forth by M. Ribeiro in 1871, are cited by Professor Whitney as furnishing conclusive evidence of the presence of man in Portugal during the Pliocene period. In his admirable memoir on The Auriferous Gravels of the Sierra Nevada, Professor Whitney has collected a great

amount of evidence which seems to prove that man existed in California at an equally remote date. Now it is perfectly clear that the human race must have been in existence for a very long time before it could have become so widely dispersed over the earth as to occupy countries so distant from each other as California and Portugal. For the first appearance of man on the earth we must, therefore, go far back in the Pliocene period at any rate; and if we are to find traces of the "missing link," or primordial stock of primates from which man has been derived, we must undoubtedly look for it in the Miocene.

Of the three stages of the Tertiary period here passed in review, we have seen that the Eocene was characterized by the entire absence of genera and species of mammals identical with those now living; in the Miocene there were genera, but no species, identical with those now living; in the Pliocene there was at least one species in Europe that has survived to the present day. When we come to the Pleistocene age, we find a majority of the species identical with such as still exist. But in regard to this Pleistocene fauna there are some curious circumstances, which show that the climate of Europe had begun to be subject to vicissitudes such as it had not known in the earlier Tertiary epochs. Among the Pleistocene mammals of Europe we find such as are characteristic of warm climates,—as the lion, leopard, hyæna, elephant, rhinoceros, and hippopotamus; and along with these we find such as characterize sub-arctic climates,—as the musk-sheep, reindeer, glutton, arctic fox, ibex, and chamois; and yet again we find such denizens of the temperate zone as the bison, horse, deer, wild boar, brown and grizzly bears, wolf, and rabbit, to which may be added the mammoth and woolly rhinoceros.

Now, as Mr. James Geikie has ably shown, this singular juxtaposition of northern, southern, and temperate forms points directly to great vicissitudes of climate. It is quite clear that when the reindeer came down as far as southern France, the climate must have been very different from what it was when the hippopotamus bathed in the Thames. We know otherwise from purely geologic evidence, that the Pleistocene climate was very extraordinary. Hitherto, during the Tertiary period, the temperature of Europe seems to have been steadily but slowly decreasing, from the Eocene epoch, when it was subtropical, to the end of the Pliocene, when it was temperate, though warmer than at present. But in the Pleistocene epoch there were at least four or five, and probably several more, extreme changes from a warm to a cold climate, and back again. This period, or the greater part of it, has been known as the "Glacial Epoch" or the "Great Ice Age"; but recent researches have shown that over Britain and central Europe there were several glacial epochs, alternating with warm inter-glacial periods of long duration. When the cold was at its maximum, the whole area of Finland, Scandinavia, and Scotland, with the North and Baltic Seas, was buried under a stupendous sheet of ice, varying from 1000 to 2000 feet in thickness; and this ice-sheet sent off glaciers as far east as Moscow and as far south as Dresden, while the Alps, the Pyrenees, and the mountains of Auvergne became centres of glaciation, inferior, indeed, to the great northern ice-sheet, but still immense in

extent. While the climate of Pleistocene Europe thus came to be similar to that of modern Greenland, parallel phenomena were occurring all over the northern hemisphere. The continent of North America was deeply swathed in ice as far south as the latitude of Philadelphia, while glaciers descended into North Carolina. The valleys of the Rocky Mountains supported enormous glaciers, and the same was the case in Asia with the Himalayas. It was during these recurrent periods of arctic cold that the reindeer and musk sheep found their way to the south of France, while over land-bridges at Gibraltar and Malta the leopard and elephant retreated to Africa. In the intervals between these glacial periods, when the climate became milder than it is at the present day, the arctic mammals traveled northward again, while the lion returned to chase the bison and elk in the forests of Yorkshire.

As the result of these prolonged and repeated climatic vicissitudes, and of the complicated migrations entailed by them, many of the Pliocene mammals still living in Europe at that time have become extinct,—such as the gigantic beaver, the cave-bear, the sabre-tooth lion, five species of deer, three species of elephant, and two of rhinoceros. One race of men—known as the "men of the river drift"—had taken up their abode in Europe when these great changes were beginning, and struggled with the extremes of climate like their enemies, the bears and hyænas. The discovery of flint knives has abundantly proved that man was living near the site of London before the big-nosed rhinoceros had become extinct, and before the arrival of the musk-sheep and the marmot in the valley of the Thames heralded the slow approach of the northern ice-sheet. But the fact that human remains of a date even more remote than this have also been found in Portugal and California shows, as I have said already, that man was then no new-comer upon the face of the earth, but must certainly have been in existence for many thousands of years, though as yet we are unable to assign either his primeval habitat or the precise epoch of his first appearance.

This "man of the river-drift" seems to have become extinct during the Pleistocene period, like the great mammalia above mentioned; and his place was supplied by a hardier race from the north,—the so-called "cave-men," of whom the modern Esquimaux have been thought to be a surviving remnant. Of the Arrival of Man in Europe, and of the probable antiquity of this era of recurrent ice-sheets, at the beginning of which he made his appearance in Gaul and Britain, I shall have something to say in another paper.—*Atlantic Monthly*..

FOSSIL MEN AND THEIR MODERN REPRESENTATIVES

Under the foregoing title, Principal J. W. Dawson has published, through Dawson Brothers, of Montreal, an "Attempt to illustrate the characters and condition of prehistoric men in Europe, by those of the American Races." In this volume we have really two books, upon entirely different subjects. What we may call book first is a parallel between the ancient town of Hochelaga, discov-

ereed by Cartier in 1534, and occupying the site of modern Montreal, and the ancient stone people of Europe. The author's opportunities for following up a line of investigation initiated by Sir John Lubbock have been exceptionally good and he has not failed to use them, supplementing the data of Hochelaga with facts collected among our present red Indians. In the course of the argument the author throws out some pregnant suggestions; as, for example, the impossibility of maintaining the definite nomenclature of archæology popular ten years ago; the similarity of the oldest populations of Europe, the river drift and the cave men, to American aborigines; the identity of Schoolcraft Allegans with the Mound-Builders; the anteriority of polished stone to rude stone folk; the spoke-like burial in the mounds as an imitation of lying in a teepec with the feet to the fire; the communal characters of the Swiss palafittes; the totemic significance of the engravings on bone in the European caves, etc. The portions of the volume designated here as the second book, are an argument to prove that all the events indicated by the discoveries of archæologists, in river drifts, in caves and in lake deposits, occurred in a few thousands of years. Without trying to follow Dr. Dawson in his discussion, it is but fair to say that his profound knowledge of palæontology has enabled him to present the brachy-chronic view of archæology more forcibly than Mr. Southall or any other recent writer who has made the attempt.

EOCENE FISHES OF WYOMING.

At a meeting of the New York Academy of Sciences, held December 1, 1881, President Newberry exhibited some very fine quartz crystals from Herkimer Co., N. Y., and also two slabs of perfectly preserved fossil fishes from the extensive Eocene formation of Wyoming Territory. This formation, which is about 7,000 feet thick, shows evidences of three successive deposits, and is exceedingly rich, not only in the remains of fishes, but of birds and mammals. The abundance of fish remains is accounted for by the supposition that the fish were overtaken by some sudden disaster, by which great numbers perished at the same time; that they floated for a while on top of the great lakes they inhabited, and eventually sank to the bottom. The occasional great mortality of fish in the Gulf of Mexico, where the decaying remains sometimes cover a very large area, to the great annoyance of travellers, furnishes an analogy to these prehistoric catastrophes, and suggests the explanation that they were caused by the evolution of poisonous gases from the bottom during volcanic eruptions.

Captain Blake stated that, during the great eruption of Mauna Loa, in 1841, the surface of the water was covered with dead fish for miles. Dr. Martin suggested that numbers of small fish frequently perish near the shore by being cut off in lagoons left by the receding tide. As the water evaporates the fish are brought more and more closely together, until, finally, there is not sufficient water to keep them alive.

BENEVOLENCE FOR SCIENCE.

B. B. Redding, a San Francisco gentleman, recently made the Academy of Sciences of that city a present of $20,000, which he designated as a permanent fund, the interest of which is to be applied to aid students in original investigations in all branches of science in California, Nevada, Oregon and Arizona.

Referring to the above we call attention to the following appeal for aid for our own Academy of Science, which we clip from the *Mid-Continent :*

"Is not the time approaching when the friends of science in Kansas City will remember the Academy of Science in a substantial manner by way of bequests and legacies? Organized December 2, 1875, it has already shown an earnest of what it might do had it more means at command. The Academy has two functions: to increase and to diffuse a knowledge of science. As Kansas City has no institution of learning of a higher order, there are but few original observers in our midst. Prof. Nipher when here, said: 'People in great cities are too busy to think.' The Academy has naturally drawn in the popular element, and done more to diffuse than increase a knowledge of science. Many valuable papers have been read, some of which have been published in Europe. The best talent in the city, and in Kansas and Missouri, has been engaged by the Academy. Prof. Proctor and Col. Fairman, the two leading lecturers in the world in their respective departments, have lectured under the auspices of the Academy. The Academy has also done some original work in the way of observation and investigation. The discovery of the Clay County mounds, and their subsequent development, would have honored any veteran society.

"But the work of the Academy so far has been carried forward by a few devoted friends of science. It has struggled for an existence and been dependent on the annual fees. It needs a permanent fund and a home to do substantial work. It needs a cabinet, a museum and a library. It wants appliances to illustrate scientific lectures. It needs means to publish its transactions. It wants funds to cary on original investigations and observations. It needs a scientist as secretary, who can devote his whole time in making collections.

Such an Academy in Kansas City would exert a powerful influence over the whole city. Men in the whirl of commercial centers need to have their attention arrested and directed to higher and nobler themes. We need to put ourselves in connection with the world of thought and attract hither distinguished scientists. The fresh currents of scientific thought are thus brought and find their way through lectures and papers to all inquirers, and are diffused by the press so as to reach every home. Has not the time come for the benevolent in Kansas City to remember their Academy? The Kansas Academy has been provided for by the State, and given a place in the Capitol building. The Philadelphia Academy has probably a million of dollars invested in buildings and collections. This is also true of other Academies. A benevolent lady in Kansas City has endowed an opera-house. Is there not some benevolent person in Kansas City who will do so much for science—one of the noblest objects of benevolence in the world.

GEOLOGY.

ARCHÆAN ROCKS OF MISSOURI.

BY G. C. BROADHEAD.

This includes the Granites and Porphyries and their associated and intrusive beds in Southeast Missouri. The granites are generally coarse-textured, feldspathic and quartzose, deficient in mica; are red or else of various shades of gray light or rich gray, or blending into a reddish gray. They crop out in massive beds in the northern portions of Iron and Madison and the southern part of St. Francois County, with isolated exposures in St. Genevieve and Crawford. They afford our best quality of building stones. In some localities we find evidence of disintegration and decomposition on a grand scale, as for example, eight miles west of Fredericktown. At this place Mr. A. Tucker sank a well seventy-five feet deep passing through granitic sand.

At Lloyd's, in the western part of Madison, south of Blue Mountain, are also found evidences of considerable disintegration. These are probably due to chemical causes and must not be brought forward as evidence against the general use of granite. A majority of the outcrops show massive beds with no disintegration. We must also remember that these rocks have been exposed to the action of the elements through a long course of ages, and viewing them thus, we find that the disintegration of more recently formed rocks is much greater.

The phenomenon of rocking stones is finely exhibited near the Ozark granite quarries, four miles southwest from Iron Mountain, while other beds near by are firm and appear resistless to the continued action of atmospheric agency.

In the northern part of Madison County, east of St. Francois River, granite appears over an undulating district, generally of a gray color, porphyritic near the Iron Mountain Railroad. West of the St. Francois River the red granite rises into mountain peaks, as Huckleberry Mountain, Bellmar Mountain and Stone Mountain. The latter on the south is a porphyritic granite. A syenitic granite forms a "shut-in" * on the St. Francois River near the Einstein Mines, and forms the "rapids" on the river. At this place it is traversed by a dyke of black dolerite forty-four inches wide, bearing S. 60″ W. A few miles north, on the banks of St. Francois River the granite contains numerous specks and scales of micaceous iron and also much iron pyrites. We find it here overlaid by horizontal beds of sandstone and conglomerate.

* "Shut-in," a local term signifying that steep rocky cliffs approach close to each bank of the stream.

A half mile west the granite is traversed by a narrow dyke of black dolerite eleven inches wide at the north end and four inches at the southern end. From the north end it bears South 32° West, for thirty feet, thence it gradually curves to South 82° West, a distance of five feet. The adjacent granite wall has been slightly darkened and indurated by contact.

At the Lloyd place, in Sec. 15, T. 33, R. 5 E., a shaft in decomposed syenite has revealed a vertical dyke eighteen inches wide bearing northeast and southwest. Two hundred feet northwest another shaft reveals a north and south dyke of similar rock two feet wide. The dyke is of a gray dioritic character. A quarter of a mile east there is a greenstone dyke eight feet wide bearing a little west of north. At King's, a mile northeast, there is a small vein of specular iron bearing northeast in decomposed granitic sand. A similar vein cuts a red syenite in Sec. 29, T. 34, R. 6 E., and bears N. 15° W. Near King's and at Lloyd's, washings in the roads reveal a good deal of black, shiny particles of magnetic iron sand. The sands of Lloyd's shaft will wash out a good deal of this sand. Similar sand has been found at many places in the northern portion of Madison, Iron and Reynolds, and also in St. Francois County.

In the southern part of St. Francois County, west of St. Francois River, a pit has been sunk on a rich deposit of micaceous iron, which being very soft was at first supposed to be graphite. The granite is also sometimes traversed by quartz veins as in Sec. 2, T. 33, R. 5 E., and in Sec. 6, T. 33, R. 6 E., also on Cedar Creek, where quartz crystals measuring over six inches in diameter have been obtained.

At the Einstein silver mines in Madison County, the rocks indicate an association of diorite and serpentine. The exact position and relation of the beds could not be ascertained, as all work had been suspended, but the specimens left on the ground were of serpentine, green and violet-colored fluor, white quartz, argentiferous galena, wolfram, iron pyrites and zinc blend. The massive rocks at the river are red and gray granite, with red porphyry just west.

Only recently has much attention been directed to the quarrying of granite. This industry is yet in its infancy, but, at present, is indicative of increasing activity. A demand is growing in St. Louis for good material for street-paving, and as the city grows so will this demand. Granite is now being placed upon several streets, and new quarries are being opened in the granite district. Washington avenue and Broadway, at end of the St. Louis bridge, has been paved for six years or more with granite blocks, and the paving is good yet. Polished columns of the Singer building, McLane's building and several others are of Missouri granite. The counter, columns and panels of bar-room of the Southern Hotel, St. Louis, are of Knob Lick granite and are very handsome. Missouri granite has also been used in the Custom House and St. Louis bridge.

Feldspar from the St. Genevieve granite quarries has been used for several years in the glazing of certain iron-ware. At the Insane Asylum, St. Louis, the borings, after passing through 3,400 feet of Palæozoic rocks, penetrated red granite. Extensive arrangements for quarrying have been made at the quarries near

Knob Lick, St. Francois County, and the Ozark quarries near Iron Mountain. At the Knob Lick quarries active work under the present owners began October, 1880, and for the year beginning then the product amounted to $100,000. These quarries now belong to Allen & Smith.

Porphyries are often exposed in Madison, Iron, Wayne, St. Francois and Reynolds, and from the highest peaks in those counties, being elevated from 200 to 660 feet above the valleys. The foot of these mountains is generally flanked by porphyritic conglomerate, or else limestone and sandstone of the Potsdam age. The testimony of the rocks goes to show, that, previous to the formation of the sandstone and limestone, the country presented the appearance of rough porphyry knobs rising 1,000 to 1,500 feet above the sea. In these depressions was the Potsdam sea, in its early ages quite tempestuous, as evidenced by the conglomerates and coarse sandstone, chiefly formed of eroded fragments from the Archæan. These sandstones occupied the shore line of the Potsdam sea. In the course of time these waters became more quiet and calcareous sediments with occasionally sandy matter were formed; but observation shows that this deposit in no place extends along the Archæan slopes over 350 feet above the present valley.

These porphyries in their typical and most common form seem to be a fine-grained impalpable mixture of orthoclase and quartz, generally of a red, brownish or purple color, sometimes dark gray or black; are porphyritic chiefly from the presence of feldspar crystals and often of grains of crystallized quartz. Most of the porphyries on their edges show a shade of red. Many of them are banded and show cleavage planes, and in some we find well marked lines of stratification, and some even show ripple marks indicating a sedimentary origin. At Pilot Knob the porphyry incloses rounded pebbles. Epidote, hornblende and serpentine occur, also beds and veins of specular iron, represented on a large scale at Pilot Knob, Iron Mountain and Sheppard Mountain; being magnetic at the latter place.

Slate, resembling in character roofing slate, occurs on Buck Mountain, Iron County. Dykes of diorite and dolerite sometimes occur.

At the so called Tin Mountain, in Madison County, the porphyry is traversed by coarse dioritic dykes and black dolerite. On the waters of Captain's Creek a dyke of coarse syenitic greenstone seventy-five feet wide cuts the porphyry.

In Sec. 16, T. 32, R. 6 E., there is an interesting exhibit of a series of dykes traversing dark porphyry (see figure 8 Mo. Geol. Rep., 1874). Against the porphyry wall on the east is ten and a half feet of greenstone, next west are a few inches of dolerite, then four feet of porphyry, then two feet of greenstone, then porphyry. The course of dyke is S. 45° W.

In Iron County in Sec. 9, T. 32, R. 4 E., a dyke of hornblende rock can be traced north and south for one-eighth of a mile; it standing several feet above the surface of the ground, like a wall.

On Gray's Mountain in Wayne County and in the southeast part of Iron County we find exposed beds of "Steatite."

In the northeast part of Reynolds County and northern part of Madison County eruptive porphyry has been found of a gray color and containing large crystals of white feldspar.

Near Polks' in Iron County are found amygdaloidal rocks flanked with porphyry. The Amygdules are of a white mineral. A few miles southward the porphyry contains blue crystals.

There is a good exhibition of a dolerite dyke in porphyry on Mine La Motte property at the Jack diggings. Another dyke is at a cave on Rock Creek.

The porphyries are generally very hard and difficult to work, so it is not probable that they will be used very soon except for paving purposes. The porphyries are of course very difficult to polish on account of their hardness, and necessarily will be expensive to polish; still in the future some of us may expect to see polished columns of Missouri porphyry.

There were on exhibition at the Centennial Exhibition, Philadelphia, several fine exhibits of porphyry polished columns; one inlaid table of red porphyry was valued at $7,500. This was from Elfdalen, in Dalecarlier, Sweden. It was of a dark red color and very much resembled some Missouri porphyrites. Similar porphyry is also found in eastern Massachusetts.

Having closely examined certain porphyries of Massachusetts, New Brunswick and Wisconsin, I find them all to resemble ours of Missouri. If specimens from these different localities were thrown together with a lot of Missouri specimens of porphyry, one at a glance would be inclined to say they were all from the same place. Dr. T. Sterry Hunt at various times has assigned these to the age of the Huronian. T. B. Book also assigns those of Lake Superior to same age. I thus am inclined to believe our porphyries to be of Huronian age. The granites may be older, they may be Laurentian. The trap dykes of dolerite, etc., are of an age more recent than either the granites or porphyries, and are probably of synchronous age. They are intrusive in both the granite and porphyries.

THE VALUE OF OUR COAL ANNUALLY.

The coal production of the United States for the year 1881, is estimated by competent judges to amount to seventy millions of tons, and counting the cost of mining and preparation for market, royalty or ground rent, and, a reasonable profit for the miner, as aggregating on an average $2 per ton, the output representing an actual value at the pit's mouth of one hundred and forty millions of dollars. The cost of transportation to market may be counted at an average of one and a half cents per ton per mile, which, for an average haul of 150 miles, would make say one hundred and fifty-seven millions of dollars for the whole amount delivered to consumers. Adding to this the expense of marketing, commissions, interest, etc., which may be placed at fifty cents per ton, and we have the actual cost of our seventy million tons of coal to consumers as nearly three hundred and thirty-two millions of dollars. From the mean value of about $4.75, the cost

varies greatly. At some points where large consumers mine their own coal, the cost to them is even less than sixty cents per ton, while small consumers at distant points have to pay at times as much as $9.50 per ton, as may be seen in our regular trade reports.

Our gold and silver mines turn out annually about seventy five million dollars worth of the precious metals, or only a little more than one-fifth of our coal industry. According to Mr. James M. Swank's preliminary census report, the value of the products of the iron and steel works of the United States was close upon three hundred millions of dollars—less, therefore, than the value of the product of our collieries. Our farmers raise annually about three hundred millions of bushels of corn, which, bringing at an average one and a quarter dollars a bushel, makes the average value of the crop three hundred and seventy-five millions of dollars, or about forty millions more than the sum realized by the sale of "black diamonds." Directly and indirectly, in the mining, transportation, and distribution of coal, the trade supports more than four millions of our people.—*Coal.*

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, February 27, 1882.

The scientific world here is very much occupied with the subject of nervous affections; also, of the curious phenomena to which they give rise and that may be included under the generic titles of hypnotism and magnetism. Dr. Dumontpollier, of the Hospital de la Pitie, has conducted some very interesting experiments upon patients, calculated to throw not a little light upon those complex phenomena vaguely denominated animal magnetism, somnambulism, etc. It is necessary to separate the true from the false in mesmerism. The subjects operated upon in the Hospital de la Pitie, suffer from nervous disorders more or less complex. Some have one side of the body insensible, others the entire system so affected that they can be cut or burned with impunity. Often they appear in a cataleptic condition, that is, the members, while retaining their suppleness, remain in the position imparted to them. Very singular attitudes can thus be given.

There are patients with whom the lethargic state arises suddenly and continues during several hours, days and even weeks, while again with others the nervous attacks are of a most extraordinary energy; the members contract in such a manner as to display frightful contortions; often the body is bent in two like the arc of a circle, with the head and feet for points. Occasionally there is an excess of gayety or of fury; of eccentric attitudes and startling hallucinations.

While these phenomena are peculiar to the hysterical and cataleptic, it would be erroneous to deny their existence, attenuated of course, in persons of sound health. The human organism rests on the extreme limit between disease and health, and a mere nothing can compromise the equilibrium.

Dr. Charcot has demonstrated that the cataleptic and sleeping states can be induced at pleasure, in the case of hysterical epileptical individuals, by means of physical agents, as the influence of light and sound, for example. A ray of light striking the eye, a look even, the tick of a watch, etc., sufficed to determine the cataleptic condition, where the patient became insensible over the whole body; the members retained the position in which they were placed, the visage reflecting the expression of the gesture. If the features displayed a tragic air, place the hands in the attitude of prayer and the expression became softened.

So long as the light strikes the eye, the cataleptic state continues, but interpose a screen between the eye and the light, or simply close the eyelid, and the catalepsy disappears as by enchantment, the members, raised or folded, fall inert, and if the patient be in an upright position he will tumble. Then the magnetic or somnambulic sleep ensues, or what is more correct, a condition of lethargy—total and absolute. But there is produced at the same time a degree of muscular excitability very extraordinary. The slightest touch of the skin induces contractions more or less energetic, which latter resist the most violent efforts to undo; the arm rises up, the leg contorts, the fingers close, despite every effort to oppose these movements. The operator cannot give, as heretofore, what position he pleases to a member. The slenderest touch, and the muscle acts against everything, as if set in motion by a hidden spring.

While in this condition the patient's intelligence is frequently excited also: he comes when commanded; sits down, gets up, kneels; obeys, in a word. But he will never knock against any article of furniture, having the appearance of being protected by second sight. To terminate this state, it is only necessary to blow on the face of the subject, who is seized by spasm of the throat, bringing froth to the lips, then full awaking; but no remembrance of what had occurred. M. Descourtis maintained one eye of a patient under the influence of light and closed the other; results: one-half of the body was cataleptic, the other lethargic.

Connected with this matter is the application of pieces of certain metal to the surface of the body to restore sensibility. Dr. Burg has identified himself with this study since 1862, and has obtained very strange, but important results. Some patients are more impressed by one metal than another. If a small plate of copper be placed on the affected limb of a person insensible in one-half of his body, and the flesh pricked, the patient will feel in the part hitherto insensible, while the same portion of the other, the healthy limb, will become devoid of sensibility. These effects are but transient, and demonstrate that what is gained on the one side is lost on the other. Identical results ensue with feeble currents of electricity suitably applied.

A patient was admitted into the Pitie hospital, absolutely insensible to pain; plates of platina and of silver were applied, but no sensibility was provoked. I was remarked, that the patient wore a silver ring; the doctor pricked the part of the finger covered with the ring, and immediately the patient started. Silver alone could not produce that sensibility, as it had been already tried. The ring was then analyzed, and found to be an alloy of copper. Copper and silver plates were then applied to the forehead and the umbilical region, strange as it may appear, when the whole body gradually became sensitive.

In the lethargic state, the patient is in a very high degree of nervous irritability: a fly touching his skin, can induce contractions; even the slightest vibrations induce a movement in the whole nervous network, similar to that which takes place when fulminating matters explode under the influence of determined vibrations. Judge: the patient is in his hospital bed; he is sensitive on one side of the body, cataleptic on the other: by means of a mirror, a ray of light is thrown on the muscles of the sensitive leg, by these, to us invisible mechanical vibrations, the limb trembles, slowly rises up, the abdomen inflates, the contraction arises at its maximum, the abdomen swelling, despite a weight of 224 pounds placed thereupon; then the contraction diminishes, the abdomen lessens in volume, the tetanic stiffness disappears. The vibrations of light which produced these phenomena, also induce their cessation.

Heat, cold, sound, a magnet, even a common bellows will produce the same effects as light; the patient thus resembles a puppet; the members, if cataleptic, can be placed in any posture, the other moiety of the body, if sensitive, can be contracted to a very high degree; indeed one half of the face can be made to look tragical, and the other gay.

With some patients, Dr. Dumontpollier, by blowing on certain parts of the forehead, or by a steadfast gaze, or approaching with his finger, causes them to immediately lose all faculty of speech and ability to write. Also, the patient can be made to lose all notions respecting the use of certain objects. Many of these phenomena are produced by mesmerists, magnetizers, etc., but strip the latter of their empiricism, their passes, their mystery, and it will be seen that, as science reveals, they are determined by physical agents. It cannot however be positively affirmed that the phenomena are absolutely produced independent of will.

The hospital experiments were conducted on persons laboring under nervous diseases; could the same be made on individuals in robust health? If it be borne in mind that disease creates nothing; morbid phenomena being only the modifications of physiological functions. Very slight causes can make a person pass from good health into sickness. In this age, especially in large cities, there are but too many on the frontiers in question; nervous systems are over-excited, overtaxed, especially between the ages of fifteen and twenty-five. Such individuals are fit subjects to be plunged into the cataleptic or the lethargic condition. The latter depends on convulsing the eyes; convulse the eyes and sleep is induced; the cataleptic stage follows. Such subjects, mesmerists class as "sensible:" they pass as robust, when in fact their nervous system may be out of joint. Once

lethargized, the subject between the hands of the magnetizer becomes simply a puppet. It is the realization of Descartes' automatism; the individual receives a glass, and is told to drink what one wishes; the glass induces the sensation which determines the act; then water becomes wine, milk, coffee, potatoes, or apples. It is not the will of the operator which here is in play, but the tendency to imitation on the part of the lethargic.

In an incidental discussion on solar spots, M. Faye reiterated his explanation of the cause and that for him, time only confirms, viz: that the principle of the spots is in the rotary movement of the star itself, and the coolness is produced by that movement even. The evolution of the spots, from one border to the other of the polar and equatorial bands, is due to a tendency to an equilibrium of temperature on the surface of the sun in the end to secure an equal distribution of heat.

Wheat is subject to a malady known as rust or smut; it attacks the grain in the ear, transforming it into a shapeless mass, of a morbid tissue, and destitute of all nutritive qualities. M. Davaine traces the cause of the malady to an eel-shaped worm, which pricks the tissue of the flower, and hence the development of the grain becomes abnormal. M. Braun admits the existence of the worm, but locates its action in the pistil of the flower, thus arresting development. M. Priedieu, last summer, having saved wheat so diseased when the plant came into flower, saw by the microscope the worms pricking the stamina of the flower, at the point of the ovary; the tissue became distorted into a tube which formed the kernel of the blasted grain. Preserved in the grain, the worm regenerates itself in the soil where the diseased grain is sown, and can retain its vitality for twenty-five years.

ASTRONOMY.

SCIENTIFIC CHARLATANISM.

BY PROFESSOR H. S. PRITCHETT.

OBSERVATORY OF WASHINGTON UNIVERSITY,
ST. LOUIS, MO., March 11, 1882.

Your note* requesting my opinion of an article published in the Kansas City *Journal*, and written by Mr. A. M. Blake, of Cleveland, was received yesterday. The five columns devoted to Mr. Blake contain the most incoherent mass of non-

* For the purpose of laying before our readers an authoritative and reliable denial of Mr. Blake's absurd statements regarding a change in the earth's position, which aroused some inquiry at the time of their publication, we requested Professor H. S. Pritchett to reply to them. It will be seen that such sensational stuff meets with very little mercy at the hands of a thoroughly educated and skilled astronomer.—[ED. REVIEW.

sense it has been my fortune to read in some time. The absurdity of his hypothesis and conclusions was pointed out by Mr. McCarty, whose communication was also enclosed.

Mr. Blake's paper, which is made up of glittering absurdities and sensational statements, is so completely guiltless of any argument drawn from either mathematics or physics, that it would be a waste of time to take it up in detail. The very first paragraph betrays utter ignorance of the most ordinary astronomical knowledge, although he signs himself pompously "Astronomer," and in a subsequent communication modestly refers to himself as one of the "wise men" of the country.

Stripping his expressions of superfluous verbiage, he asserts that the attraction of the planets, at the time of conjunction with the sun, has changed the inclination of the axis of the Earth to the Sun (he means, probably, changed its inclination to the ecliptic,) and thereby has brought about a change of zones.

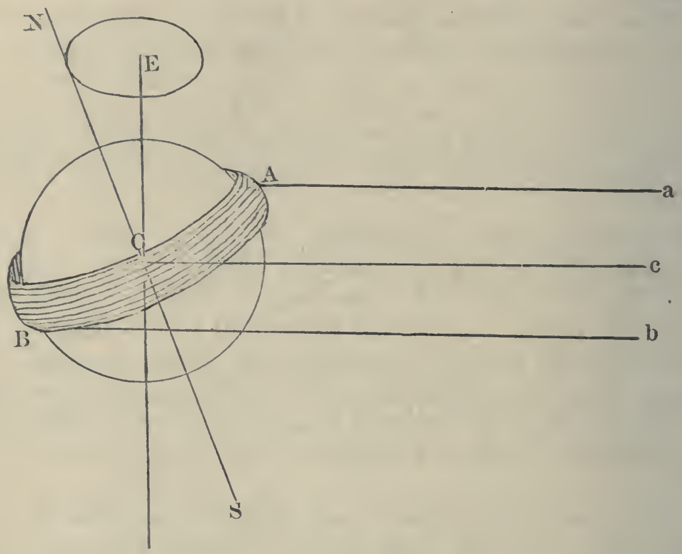
This idea that the attraction of the Sun and Moon and planets upon the Earth would change the inclination of the Earth's equator to the plane of the Earth's orbit, was advanced and refuted many years before Mr. Blake's day. His modesty in claiming the idea as an original discovery may therefore be fully appreciated.

The phenomena which actually occur, due to the attraction of the Sun and Moon on the spheroidal figure of the Earth, are explained in every text-book on Astronomy and may be made clear in a few words even to the non-mathematical reader.

The point where the Earth's axis, when produced, would meet the celestial sphere is called the celestial pole or, ordinarily, the pole. It is the point about which the constellations appear to revolve and at present is near the bright star Polaris, or the pole star. The direction of the Earth's axis is, however, slowly changing from year to year. This change in the direction of the Earth's axis or the corresponding motion of the great circle of the equator upon the ecliptic is ordinarily called the Precession of the Equinoxes. It is due, as was shown by Newton, to the unequal attraction of the Sun and Moon upon the spheroidal form of the Earth, and may be readily understood from the following figure:

If the Earth were a perfect homogeneous sphere the direction of its axis would never be changed in consequence of the attraction of another body. Suppose, however, the excess in matter about the equator to be represented by the ring A B. Suppose a distant attracting body, (the Sun), situated in the direction Cc so that the lines of attraction Cc, Aa, Bb are nearly parallel. The attractive force, being slightly stronger at A than B, on account of its smaller distance from the attracting body, there will be a residual of attracting force which would tend to pull the ring into the plane of Cc, or, in other words bring the equatorial ring into the plane of the Earth's orbit, the ecliptic. In the case of the Earth, however, a modifying force is found in the rotation of the Earth on its axis, so that this residual of attracting force produces a slow revolution of the Earth's axis about a line perpendicular to the direction of the motion, after the manner of

the gyroscope or spinning top. In the figure this would correspond to a motion of the axis NC about the line EC, or, in other words, the pole of the Earth's equator (or the Earth's axis) make a complete revolution about the pole of the



ecliptic. It requires about 25,000 years for the celestial pole to make this revo-olution. The only effect of one or more planets in conjunction with the Sun would be to increase by an almost infinitesimal amount this attraction. [*See Newcomb and Holden's Ast.*] This motion of the Earth's axis or precession of the equinoxes has been known since the time of Hipparchus. In the time of Hipparchus our present pole star was 12° distant from the pole. The pole has since steadily approached it and will continue to do so till the year 2100, when it will slowly pass by it and at the end of about 12000 years will be near the constellation Lyra.

Although the direction of the Earth's axis in space is thus constantly changing, yet the position of this axis, relative to the crust of the Earth, remains invariable. The idea was advanced many years ago that this motion of precession would result in a change of position of the North Pole on the Earth's surface, so that the northern regions would be covered with ice, as a result of the different direction in which the oceans would be carried by the centrifugal force of the Earth's rotation. Had such a stupendous change taken place in the short space of time allotted by Mr. Blake, it would have been its own messenger of woe, and no prophet or "wise man" would have been needed to announce its arrival.

It has been shown, however, mathematically, that the position of the poles, and therefore of the equator on the Earth's surface, cannot change except by some variation in the arrangement of the Earth's interior. Scientific investigation has as yet shown nothing to indicate any probability of such a change.

It is to be regretted that the newspapers should devote their columns to printing such absurdities as these uttered by the astronomer(?) of Cleveland; the more so because it is printed in all seriousness as the result of real scientific investigation; whereas the entire article is not only absurd and untrue, but the fallacy of the hypothesis was exposed so long ago that it has become part of every college text-book on astronomy.

At the present day two classes of men are engaged in the retailing of scientific sensations. One class may be denominated the scientific fraud. It includes those men who are utterly without scientific training and ignorant of what has been already done, but who by vigorous shouting and the use of high-sounding terms obtain among a certain class a great reputation for learning. Such men may or may not believe the the vagaries they attempt to teach.

The other class is composed of men more or less skilled in science, but who spend their time in writing for the newspapers and beguiling the public with sensational theories. Such men generally suggest much more than they assert and avoid a direct statement. To this class belong those astronomers who keep a convenient comet lurking about the outskirts of the solar system, ready at short notice to plunge into the sun and create a conflagration that shall destroy us all. It may be incidentally remarked that both classes secure more money and more attention from the general public than hundreds of honest workers in science whose work is for all time. It is needless to say that no one could ever suspect the author of the before mentioned article to belong to the second of these classes.

It is to be hoped that the time may come when such men may no longer be able to gain the public ear by ranting over sensational hypotheses which have been exploded years before.

COMETS; THEIR COMPOSITION, PURPOSE AND EFFECT UPON THE EARTH.

BY PROFESSOR LEWIS BOSS, DIRECTOR OF DUDLEY OBSERVATORY.

A few months since Mr. H. H. Warner, of Rochester, N. Y., founder of the Warner Observatory, announced a special prize of $200 for the best essay on "Comets, their Composition. Purpose and Effect on the Earth." One hundred and twenty-five essays were sent in to Director Swift, of the Warner Observatory, and after a careful review, the judges—Professor Elias Colbert, of Chicago, Ill., Professor H. A. Newton, of Yale College, New Haven, Conn., and Professor H. M. Parkhurst, of New York City,—unanimously awarded the prize to the essay signed "Hipparchus III," by Professor Lewis Boss, Director of the Dudley Observatory, of Albany, N. Y. Following is the full text:

Though modern science has taught us much concerning the physical nature of comets, no one has yet been able to construct a theory which is either complete or free from objection. With these facts in view, and so far as possible within

our brief limits, and without the use of technical language, we will endeavor to outline some of the more important results of observation and reflection upon this subject. We shall be obliged to draw freely from the results elaborated during the last fifty years by Bessel, Winnecke, Bond Newton, Zœllner, Bredichin and many others, without reference to individual authorities or digressions upon rival theories and claims.

METEORS—OFFSPRING OF COMETS.

§ 1. About twenty years ago it was proved that certain annually recurring displays of meteors are due to swarms of small bodies, which revolve about the sun in elliptical paths, so situated in space as to encounter the earth at nearly the same time in each succeeding year. These paths or orbits were found to be identical in some cases with those of certain well-known comets. The conclusion seemed irresistible and is now accepted, that shooting stars, or meteoroids, are simply the offspring of disintegrated comets.

Most likely, aërolites (large meteors) which sometimes reach the surface of the earth, are of the same origin. These bodies usually enter our atmosphere with velocities (relative to the earth) ranging from twenty to forty-five miles per second. In consequence of the inconceivable heat which would be generated by such contact—manifested by the fiery train they leave behind—the smaller meteors, however dense, would be at once converted into impalpable vapor. Only the larger ones could survive the tremendous encounter, and reach the earth. Still others, composed of more fusible substance, though very large, may be unable either to overcome the mechanical resistance of the air, or the transcendent heat produced. Furthermore, that fiery ordeal must strip aërolites of all volatile matter and leave only refractory substances behind. Hence, analysis of meteoric stones might give us an idea of the real composition of comets which would be totally misleading; just as the ruins of a house, destroyed by fire, would be no index of the chemical composition of all the material it contained before the disaster.

TESTIMONY OF THE SPECTROSCOPE AND POLARISCOPE.

§ 2. The Spectroscope (light analyzer) rather reluctantly yields some testimony as to the chemical and physical nature of comets. It seems to show that the nucleus is a solid or liquid incandescent (at a glowing temperature) mass. It proves quite conclusively that the matter surrounding the nucleus contains hydrogen and carbon in one of their numerous compounds. The flame of the Bunsen burner, which contains one of the compounds, shows a spectrum (light analysis) which is very similar to, if not identical with, that observed in comets. Some observers have reported that these elements give evidence of their presence in the tails of comets at considerable distances from the head. If so, we must suppose the attenuated matter of the tail to be self-luminous. This may be attributed to some form of electrical action; since, considering the low temperature of space, it cannot be due to incandescence produced by ordinary heat.

Recent observations with the spectroscope seem to prove that a part of the light from comets is really reflected sunlight, since it faintly exhibits a spectrum like that of other bodies which shine by reflected light alone.

The Polariscope (instrument for detecting reflected light) also gives evidence which leads to the same conclusion. The use of this instrument in examining faint sources of light is attended with great difficulties; and in the present connection, the records of different observers are not strictly harmonious.

RECORD OF THE TELESCOPE.

§ 3. Comets are seen in their simplest form as faint patches of nebulous light. They are usually circular or oval in outline, without remarkable difference of brightness from center to circumference. At a latter stage of development the comet shows a diffused brightness in its central parts, known as central condensation.

When a large comet approaches the sun, the structure becomes far more complex. The center condensation gathers intensity. Finally, a point or disc of light appears near its center, which shines with a light approximating that of the planets. This is called the nucleus.

NUCLEUS HAS NO DEFINITE MAGNITUDE.

Observers with powerful telescopes usually find that what we commonly call the nucleus has no definite magnitude. It continually measures less with increase of optical power. The inference is that the real nucleus, if it consists of a single solid body, must be very small, and much obscured by the vapors which surround it. Generally the nucleus appears to shrink in size as it approaches the sun. The most plausible explanation seems to be, that with lessened distance from the sun, the real nucleus gets hotter and brighter and at the same time the vapors near it become more transparent. Other explanations have been offered which we have no space to consider.

THE ENVELOPES.

We commonly find that the coma (nebulous matter about the nucleus) appears much brighter on the sunward side. In many cases, streams of matter appear to issue from the nucleus on that side. These assume a variety of forms, and are almost always curved backward, from the direction of the sun, at their extremities. Above the streams, or jets are sometimes seen one or more arcs of light, concentric with the nucleus from which they appear to recede,—just as waves recede in widening circles from a stone dropped into still water. These envelopes, as they are called, are supposed to be hollow spherical segments of matter, more dense than the surrounding parts of the coma.

One highly important characteristic of the matter which surrounds the nucleus is well established. The rays of light from distant stars seen through it are not sensibly bent, or refracted. This shows that gases to an appreciable amount do not exist in comets.

THE PHENOMENA OF THE TAIL.

The strange appearance of the tail and the gigantic dimensions it sometimes attains, are well calculated to arrest the attention of mankind. It is not wonderful that the ancients should have regarded it with trembling apprehension, nor is it surprising that even yet, it excites an absorbing curiosity among the educated, and the superstitious terrors of the ignorant. The matter of which it is composed must be expanded to an almost inconceivable degree; for even when it is millions of miles in diameter, the light of the faintest stars is seen through it with scarcely diminished brightness.

THE BLACK STREAK IN THE TAIL.

Near thh head, it often appears to consist of two streams of matter issuing from either side of the coma with a dark channel of separation between. The tail at this point generally appears to have the same diameter, from whatever direction in space it is viewed. We must, therefore, conclude that its interior is nearly or quite free from matter, and like a hollow cylinder, or portion of a cone, as far as the dark channel extends. Beyond that point we may suppose that the interior fills up by gradual diffusion from the circumference: in some cases, and especially with small comets, the dark channel is wholly wanting, or but faintly indicated.

CURVED DIRECTION OF THE TAIL.

In order to give an idea of the situation of the tail in space, let us imagine a line from the sun continually prolonged through the moving head of a comet into space beyond. We shall always find the tail extending nearly opposite the sun, in the general direction of this prolongation, but curved more or less backward from it, in the direction from which the comet is moving. Sometimes we find more than one tail—each distinguished by the degree of its backward inclination. They have, indeed, been classified on this ground and found conformable to three general types.

ORIGIN OF COMETS.

§ 4. The facts thus far presented, prove nothing as to the origin of comets. That question demands for its solution mathematical reasoning based on the calculated paths of all comets which have been observed. That discussion is beset with great difficulties, and as yet points to no absolutely certain conclusion. The balance of testimony seems to favor the supposition, that comets originate outside the solar system. The planets move in nearly circular orbits about the sun; and no one has been able to show why comets, if they have the same origin, should move in elongated orbits, entirely differing from those of planets.

Let us suppose, however, that all comets must have taken their origin in some primeval nebula from which a solar system has been evolved. It has been shown that the velocity of a comet may be so much increased by the disturbing action of a large planet, that it may escape from the control of the sun, and be projected into the illimitable regions of space. Thus freed, it will go on in a nearly straight line forever; unless, perchance, some powerful source of attrac-

t
ion, like another sun, lying near its path, arrests its flight. The possibility of such an occurrence is by no means imaginary. At least one comet (Lexell's, 1770,) is supposed with good reason to have undergone that fate. There is every reason to believe that the same thing may have happened in other cases.

STELLAR COMETS.

All arguments drawn from observation and reflection prove that the stars which surround us on all sides are remarkably like our own sun. Some of them are even larger and more powerful than he. Reasoning from analogy, we must suppose that these suns are also attended by comets. Hence, we are led to the conclusion that uncounted myriads of comets, projected forth from millions of suns, during countless ages past, are now flying through space in every direction —restless messengers from star to star. By mere chance some of these bodies must come under the sun's far-reaching power and be drawn into our planetary system.

PHYSICAL HISTORY OF COMETS.

§ 5. The mass (quantity of matter) of comets is conceded to be very small in comparison with that of the earth. How small it is, we cannot say. No comet has been found large enough to exert a sensible attraction upon any celestial body found in its vicinity. This fact confirms the conclusion derived from telescopic examination, that the real, solid nucleus, if it exists, must be extremely small.

It is certain that no body entirely gaseous could exist in space. The conditions for the stability of liquid bodies in their practical application to the explanation of cometary phenomena, are extremely complicated; since they are closely associated with the unknown elements—mass of the comet, solar radiation, and absolute temperature of space. It would also be extremely difficult to show how a swarm of small bodies could be preserved in a state of equilibrium, or resist the tremendous tidal action to which it would be subjected in the vicinity of the sun. In fact, we must view the conversion of a comet through some unusual catastrophe, into such a swarm, as the sure precursor of approaching dissolution. On the whole, it is probable that there is a solid or partly liquid body near the center of the comet. This body is more likely to consist of an aggregation of loosely cohering pieces or particles, than of a single firmly united mass.

Owing to the smallness of their attractive force, comets cannot retain a sensible atmosphere. This conclusion is confirmed by telescopic observation, as we have seen.

If, now, we suppose the nucleus to be approaching the sun, it will eventually reach a point where the liquid or other volatile matter on the "sunny" side commences to evaporate and be diffused about the comet. Without following the consequences of this evaporation into details, one can imagine for himself how the appearance of central condensation, of the streaming jets, and of the nucleus heavily obscured by vapors, might be produced.

To account for the backward curvature of the jets and the peculiar form and direction of the tail, we must look for some additional force. In all probability this force resides in the sun, and is directly opposite in its effects to the power of gravitation. But since the body of the comet obeys the law of gravitation with sufficient fidelity, we must find a repulsion which sensibly acts only on the molecules of gas or vapor.

The only force suggested by experience as competent to these requirements is that of electrical repulsion. Any one can prove for himself that two bodies similarly electrified mutually repel each other. We know that the earth, through effects of constant evaporation and other causes, is to some extent an electrified body. For the same reasons, we should expect comets to be electrified in a much higher degree. The sun itself certainly exerts an influence upon terrestrial magnetism. Violent commotions on his surface have occurred at the same time with unusual disturbances of the magnetic needle. Electrical repulsion acts in proportion to surfaces and not to volumes. On particles of matter in a state of infinitesimal subdivision it might act most powerfully, while not affecting a large body to an appreciable degree.

THEORY OF FORMATION OF TAILS.

If, then, we suppose the sun and comets to be sufficiently and similarly electrified, we have the force necessary to produce the backward curvature of the jets, and to drive off the smallest and probably outermost molecules of the coma to form the tail. Since, according to our hypothesis, very little matter can be given off from the shaded side of the nucleus, we readily perceive why the tail should be hollow in appearance.

The orbit of the moving nucleus being curved, it is evident that the particles driven off at any time with less than infinite velocity, would continually fall more and more behind the prolongation of a line through the sun and comet—just as has been observed. If the matter contains molecules varying considerably in size, the larger ones would be driven off with less velocity. These would curve backward more than would the lighter molecules driven off at the same time; and so we have the multiple tails which have been seen, as well as the classification already described. Elaborate examinations of their average observed direction and form suggest that each class may be composed of chemical elements peculiar to itself. We may even venture to suppose that the tail of greatest velocity and least inclination is composed of hydrogen. The second type may contain carbon, with or without other elements; and among those of the third, chlorine would most likely be found.

It is a common error to suppose that this hypothesis, as to the formation of the tail, requires a repulsive force of inconceivable power. The straightest tails which have been observed are accounted for by supposing a repulsive force not much greater than twelve times the sun's attractive power. The tails most frequently seen (scimeter-like in form) may be produced by a force about one-ninth

of that amount, which is but little more than sufficient to overcome the attraction of gravitation.

It will be seen that it is equally erroneous to suppose any great amount of material wasted in the formation of the tail, when one reflects upon the transcendent lightness of its structure.

HOW COMETS AFFECT THE EARTH.

§ 6. The influence of comets upon the earth is in all probability quite insignificant. They may, like the sun, affect the earth's magnetic condition, and and thus to some extent, possibly, its meteorology. No such effect has ever been perceived. In spite of some chance coincidences between the apparitions of great comets and remarkable public events, no well-informed person now believes that there is any real connection between them. By a liberal and credulous interpretation of any frequently occurring celestial phenomenon, similar coincidences could be shown.

When a comet is converted into meteoric bodies, which impinge upon the earth's mtmosphere, there is some direct though probably minute effect. Some have thought that a sensible portion of the heat which the earth receives is generated in this way; but the weight of scientific opinion seems to be against that hypothesis. The impact of meteors upon our atmosphere must add some matter to it, and this is probably in the form of dust. This may be the origin of the so-called cosmic dust, which has been collected at sea in recent times. The finer particles of it may have some influence on cloud formations, and other meteorological phenomena, but all this is merely conjecture.

A more remote effect may be sought in the possible fall of meteors and comets upon the surface of the sun. Owing to his vast bulk, the sun would attract an immense number of these bodies; but it is quite certain that their effect upon the sun's heat is insignificant. It is now generally admitted that we must look for the origin of the sun's heat in a constant, though to us, imperceptible shrinkage of his vast bulk.

Some connection between the frequency of sun-spots and comets has been rather vaguely suspected. Were the search for comets systematically pursued with equal persistence for a long period, we might have some data for the formation of a sound opinion. Yet it would still be an open question, whether comets cause the spots, or whether greater activity of the sun tends in some way to render comets brighter, so that more will be visible—with probability in favor of the latter supposition.

Finally, it may be said with all due respect to scientific decorum, that the appearance of a great comet does exert one most happy influence on the earth, in that it stimulates the curiosity of mankind and directs their thoughts to the more particular contemplation of the glorious universe which surrounds them.

ASTRONOMICAL NOTES FOR APRIL, 1882.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.	Declination N.	Equation of Time.
1st.	00h. 43m.	4° 41′	3m. 49s. +
5th.	00 58	6 13	2 37
10th.	1 16	8 05	1 12
15th.	1 34	9 54	0 04 —
20th.	1 53	11 39	1 13
25th.	2 12	13 18	2 12
30th.	2 31	14 53	2 57

Semi-diameter on the 1st, 16′ 02″; on the 30th, 15′ 54″.

THE MOON.

Date.	Right Ascension.	Declination S.	Semi-Diameter.
1st.	11h. 26m.	1° 29′	14h. 49m.
5th.	14 35	16 57	15 13
10th.	19 13	18 32	15 58
15th.	23 52	4 03 N.	16 29
20th.	4 38	21 06	15 42
25th.	8 57	11 58	14 50
30th.	12 43	8 46	15 05

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Transit.
1st.	23h. 19m.	6° 55′	10h. 36m. A.M.
5th.	23 41	4 42	10 42
10th.	0 10	1 29	10 51
15th.	0 42	2 09 N.	11 03
20th.	1 16	6 10	11 17
25th.	1 52	10 26	11 34
30th.	2 32	14 43	11 54

Apparent diameter on the 1st, 6.2″; on the 30th, 5″.

VENUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	1h. 21m.	7° 37′	00h. 42m. P. M.
10th.	2 03	11 53	00 48
20th.	2 51	16 11	00 56
30th.	3 41	19 47	1 06

Semi-diameter on the 1st, 5.2″; on the 30th, 5.5″.

It will be visible in the west during the entire month, constantly increasing in brilliancy. It will appear nearly round in the telescope.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	6h. 53m.	25° 13′	6h. 12m. P. M.
15th.	7 21	24 16	5 45
30th.	7 52	22 50	5 19

Semi-diameter on the 1st, 3.8″; on the 30th, 3.1″.

It will be in the constellation Gemini, during the entire month. On the 26th it will be in line with Castor and Pollux, at the same distance south of Pollux that Castor is north.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	3h. 33m.	18° 31′	2h. 53m. P. M.
15th.	3 45	19 13	2 10
30th.	3 59	19 57	1 25

Semi-diameter on the 1st, 16.5″; on the 30th, 15.8″.

It will be in Taurus and too near the sun to be observed well.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 38m.	13° 13′	1h. 58m. P. M.
15th.	2 44	13 45	1 10
30th.	2 52	14 20	0 18

Semi-diameter on the 1st, 7.8″; on the 30th, 7.7″.

Elevation of the earth above the plane of the ring 21°. It will be too near the sun to be observed.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	11h. 7m.	6° 29′	10h. 27m. P. M.
30th.	11 4	6 47	8 29

It will be in a very favorable position for observation, being in the constellation Leo near its eastern edge. The bright star Regulus in the same constellation will be 16° west and 6° north of Uranus, and will guide an observer in finding it. The light we receive from this planet is only equal to a star of the sixth magnitude, and it will require a good eye to find it.

NEPTUNE

Will be too near the Sun to be observed during the month.

PHENOMENA.

On the evening of the 19th Venus and Saturn will be in conjunction; Saturn will be to the south of Venus 1° 53′. The moon will be close to Jupiter on the same evening.

On the 28th, the Moon will pass south of Uranus 6° 17′.

MEDICINE AND HYGIENE.

THE SANITARY LEGISLATION OF THE PENTATEUCH.

Strange as it may sound, legislation concerning public health is not entirely a notion of this nineteenth century, sprung from the brain of the Southwood Smiths and the Chadwicks. Ages before the Society for the Diffusion of Useful Knowledge or the Sanitary Institute of Great Britain came into being, we find regulations on sanitary subjects, not merely proposed but formally enacted, invested with the most solemn sanctions of religion, and inseparably interwoven with the customs and polity of a remarkable people. These regulations, which have attracted surprisingly little notice considering that they are met with in a book which has, more than any other, been closely scrutinized both by its friends and its enemies, are, we think, not unworthy of attention from a scientific point of view. They agree most strikingly with the results of modern research, both in the recognition of danger and the precepts laid down for its removal or avoidance, and they are in too many respects far in advance of our actual practice. We propose to examine these laws, not from the position of the archæologist, the orientalist, or the divine, but simply from that of one interested in Sanitary Science. If we find that Moses has anticipated certain of our modern oracles, we shall not seek to explain so suggestive—and to some persons unwelcome—a coincidence. The question whether or no some of the laws which we shall quote may not also have other and possibly even higher meanings we must leave to be discussed elsewhere. We think meantime that no one who has carefully traced the history of the human mind need feel surprised or offended at finding precepts on bodily health presented as under Divine sanction.

We will first call attention to the subject of blood. Nothing is more emphatically and repeatedly forbidden in the Books of Moses than its use as an article of food. What is the reason of this prohibition, which, as most people know, is very scrupulously obeyed by the Jews down the present day? Theologians will perhaps pardon us if we submit that this has, in addition to other possible meanings, a physiological import which has in these days been too frequently lost sight of, even by many medical men. The enactment is surely in complete harmony with the teachings of modern science. We know that the circulatory system has

a double office: on the one hand it serves to convey fresh matter to supply the wear and tear of the system, whilst on the other hand it serves to carry off what may be popularly called the waste or refuse of the body. Such refuse is in due course eliminated by means of the kidneys, the sudiparous glands, etc., and appears then in its avowed character of excrementitious matter. It is, therefore, evident that the blood if drawn off promiscuously, arterial and venous together, contains a certain proportion of effete substances, which are only fit to be expelled, and which are ill-suited for human food. If by any derangement the action of the kidneys is arrested, this refuse accumulates in the blood, and the consequences at once make themselves felt. Now, as to separate the arterial from the venous blood of a slaughtered animal is impracticable, we contend that to use the blood as food approximates very closely to drinking urine, and is not merely loathsome but *pro tanto* unsafe. That, like liquid and solid excrements, it is valuable for plant-food, and that it serves as a pabulum for certain classes of animals is no proof that it is fit for human consumption.

Even the mechanical state of blood when coagulated is a strong argument against its dietetic use. Unlike flesh, it is not composed of fibres between which the gastric juice can easily penetrate. It is a solid structureless mass like caoutchouc, which can only be acted upon from the outside of each fragment, thus rendering the process of digestion more difficult.

Turning from theory to practical experience, we refer to the higher value—in an actuary's sense of the word—of Jewish lives than of those of their Gentile neighbors inhabiting the same locality and engaged in avocations little different. Is not this recognized superiority on the part of the Jew due, in part at least, to their hereditary avoidance of blood during the course of three thousand years?

It is generally admitted that the internal organs of animals—such as the kidneys, the liver, etc.—are of questionable value as articles of food. They are, as we learn from carcase-butchers, very frequently in a diseased state, and are apt to be the seat of entozoa. We have not succeeded in ascertaining whether these parts are avoided by the Jews at the present day. But the law seems perfectly clear (Leviticus, iii., 15, *et passim*) that in all cases of beasts sacrificed the "inwards" must be destroyed by fire.

The disposal of blood did not escape the attention of the Israelitish law-giver. Directions are given that it is not to be let stagnate on the surface of the ground and there putrefy, but to be "covered with dust" (Leviticus, xvii., 13), or, in other words. absorbed in dry earth. Hence it seems fair to conclude that more than three thousand years ago the peculiarly offensive character of putrescent blood and the deodorizing and disinfecting property of earth were known. Covering with earth is also the treatment specified for excrementitious matter. To the present day nothing is more offensively striking, wherever large numbers of human beings are collected away from their settled habitations, than the accumulation of filth which defiles the neighborhood. Not merely sieges and other military operations, but engineering undertakings, fairs, camp-meetings, pilgrimages, are characterized by nuisances of this nature, which doubtless assist in the propaga-

tion of typhoid fever, cholera, dysentery, etc., if the germs of these diseases are introduced. But Moses (Deut., xxiii., 12) gives special direction that excrement shall be dug into the earth. Indirectly this may be regarded as a prohibition against casting filth into the streams and water-courses. This view will appear strengthened by the decree that the falling of dead animals into small bodies of water (Leviticus, xi., 36) caused them to be regarded as unclean.

But whilst the use of blood as food is decidedly prohibited, and whilst its absorption in earth is enjoined, it figures in another capacity which has also a sanitary phase. It has been suggested to us that the application of blood to the doorways of the houses of the Israelites (Exodus, xii., 22 and 23) was not merely a symbolical act, but a prophylactic measure. The destruction recorded as coming upon the Egyptians was probably some zymotic disease, the proximate cause of which would be morbific bacteria in the air. It is represented to us as not improbable that these bacteria, or other microbia, would be attracted and absorbed by the fresh blood sprinkled on the door posts. This view of the case is fortified by the enactment that the Israelites were not to leave their houses in the morning. We are very far from presenting this supposition as demonstrated. But we understand that slaughtermen—who are, so to speak, constantly surrounded with *fresh* (in contradistinction to putrid) blood—are singularly free from epidemics. We have also witnessed experiments, which if not conclusive are at least suggestive. Organic solutions and infusions were placed in U-tubes through which air was drawn by means of a Sprengel pump. Before flowing into one of these tubes the air had to pass over a number of fragments of pumice slightly soaked in blood, whilst in the other cases it was passed over pumice similarly soaked in gum-water, solution of sugar, and other adhesive liquids. In almost every case the organic solutions which had received their air over blood were much slower in showing signs of putrefaction than were the others. Our friend contends that fresh blood has a positive attraction for morbific germs independent of its glutinous character. Experimentation during some outbreak of pestilence is here wanting, and in the meantime we suspend judgment.

We next come to the distinction between clean and unclean beasts as affecting the choice of food. We find excluded all carnivorous animals (Leviticus, xi., 27), the rodents (*Ibid.*, 5, 6, and 29), the carnivorous and carrion-eating birds (*Ibid.*, 13 to 19), reptiles (*Ibid.*, 30), amphibia, and mollusca (12). The question now arises whether these regulations are exclusively symbolical, or whether they have not at the same time a sanitary meaning. If we consider what animals are thus excluded, we can scarcely avoid entertaining the latter view. We find on the prohibited list, in addition to the swine—that eminently unclean beast—the mouse, and, a *fortiori*, the rat, and, as included among the carnivora, the cat and the dog. Here, then, we have in a group those beasts which are the home of *Trichinæ*, and through whose means, directly or indirectly, these parasites are introduced into the system. Is this a mere unintentional coincidence, or have we not rather a wise intention? It may be said that, save the swine, none of the animals thus mentioned are used for human food. Such an assertion would be a

great mistake. Dogs are eaten in China, in Poland, and from time to time, much nearer home, in the form of sausages. Cats enter into the Portuguese, and we suspect the Italian, *cuisine*. Rats and mice are eaten, not merely by Chinese and Gipsies, but find their way occasionally into soups, stews, and the like in Europe. Indeed, in "this our highly favored country," a certain person, probably influential and evidently ignorant, wrote to a daily paper recommending rats as food for the poor, and adding the humane suggestion that any man who complained of starvation whilst rats were plentiful should be punished! We will charitably hope that the writer was not aware that rats are foci of trichinæ, and are with good reason suspected of being one of the sources from which these pests find their way into cats, swine, and certain fishes, such as the pike. The domestic cat and all the feline group are frequently and seriously infested with internal parasites.

The prohibition of mollusca,—or, as they are familiarly called, shell-fish, and as we should interpret the passages in question, of crustaceans, such as the crab, lobster, and shrimp—may perhaps be considered needless. But not a few shell-fish, such as the common muscle and even the oyster, are at times capriciously unwholesome and even poisonous. The crustacea are not merely notoriously foul feeders—the shrimp being sometimes spoken of as the "scavenger of the ocean"—but their flesh is decidedly hard to digest. The snail is specially prohibited by name. Certain species of this animal are eaten in modern Europe and rank as a delicacy. But as they devour herbs poisonous to man, and feed greedily upon carrion and human excrement, their use as food is something more than questionable. It has been contended in reply that an animal which nourishes itself on poisonous or loathsome matter is not necessarily on that account poisonous or loathsome. There is some force in this remark in the case of a large animal, where the stomach and intestinal canal, with their undigested or half-digested contents, can easily be removed before the body is eaten. But in such small creatures as snails and shrimps such an operation could not be performed without a degree of anatomical skill and an outlay of time not to be expected from the ordinary run of cooks. Besides, it is too much to assume that an animal feeding on foul, morbid, and unwholesome matter may be in itself wholesome. The flavor and the odor of animal food, meat, milk, butter, etc., are most perceptibly affected by the diet of the beast from which they are obtained, and there is hence a strong probability that the flesh of a poison or carrion-feeder will be more or less unwholesome.

The hare is included among the prohibited species. Unlike many of its fellow rodents. it is not carnivorous, but it eats many vegetable poisons, such as the bark of the mezereon. It would be very interesting to ascertain in what animals, after death, the volatile organic poisons now known as ptomaines are most readily developed. It is possible that in this respect a difference might be found in favor of the "clean" beasts and birds of the Mosaic law.

As far, therefore, as food is concerned, we see in some instances very sufficient physiological reasons for certain of the prohibitions, and we have grounds

for suspecting at least that in other cases these regulations may be equally well founded. Certain it is that the Jews, by the avoidance of blood, of the flesh of unclean beasts, etc., have reached a standard of health higher than that of the Gentile nations among whom they sojourn. Shall we therefore justly incur ridicule if we pronounce these enactments wise?

From food we proceed to the surrounding of human habitations. Not only in the East under its modern rulers, whether Islamite or Christian, not only in mediæval Europe, but down to a comparatively late date, the streets of cities and villages were the common receptacle of filth and refuse of all kinds, stray dogs being the only scavengers. Dead domestic animals, excrements, spoiled food, bones, the rinds of vegetable, and every other noisome and unseemly by-product of human existence and activity, were allowed to accumulate in every corner. But why speak of streets? The interior of our houses, and even palaces and churches, three hundred years ago, must have been perfectly loathsome to any one—could such have been present—accustomed to cleanliness. How strange it is, then, to go back for more than three thousand years, and find in the laws of Moses directions that all unclean matter shall be cast into a waste place outside the city! The removal of nuisances was further made imperative by the command that if any person touched carrion or excrement, he shall be "unclean till the even." We can easily see that no Jew would be willing to tolerate any preventible nuisance in or near his dwelling.

We have, lastly, regulations on the subject of personal cleanliness. It is a sad fact that not merely mediæval but modern Europe contrasts most sadly in this respect with the principal nations of antiquity. One of the most striking features in the law of Moses is the number and variety of circumstances under which washing is required. Again and again we read—"He shall bathe his flesh in water." It may safely be said that in the ancient Israelitish community few persons would be able to pass a week without an entire washing. It may as safely be said that till very lately numbers of persons in modern Europe passed entire years without washing any part, save the hands and a circuit of six inches radius from the tip of the nose. So peculiar is human progress that it has taken three thousand years to bring the civilized world to a point less advanced than that occupied by Moses. Less advanced we say emphatically, because if we now admit the value of personal cleanliness, the importance of avoiding putrescent and loathsome matters, and of expelling them rapidly from our cities, and if we are theoretically aware of the disinfecting and deodorizing power of earth, we are far from embodying this our knowledge in the practice of actual life. As to the avoidance of blood, of the flesh of foul-feeding animals, and of such as are liable to introduce entozoa into our systems, we do not even recognize verbally the importance of the Mosaic teachings. We eat "blood puddings," we feed swine with blood and with semi-putrid offal, and then we eat the animals which have been gorged on this revolting diet. And we pay the price of this uncleanliness in shortened

lives and in waning vigor. We again call attention to the remarkable physiological insight displayed in the sanitary code of the ancient Israelites, and we repeat the question, Whence did it spring?—*London Journal of Science.*

BRAIN-GROWTH AND CIVILIZATION.

In a progressive civilization, such as prevails in this country and throughout the greater part of Europe and America, there is reason to believe that the cranial capacity of the population is, on the whole, increasing rather than diminishing. Owing to the want of early observation, it is difficult to institute comparisons between past and present. An opportunity, however, lately occurred in Paris, which was taken advantage of by M. Broca. In digging the foundation of a new building, a vault was opened containing a large number of skeletons, whose surroundings proved them to have lived not later than the twelfth century. M. Broca found the average capacity of 115 of those twelfth century skulls to be 1,426 cubic centimetres; while another series of skulls—125 in number—taken from a cemetery belonging to the early years of the present century, gave an average of 36 cubic centimetres more. The average Parisian skull would thus seem to have increased considerably in capacity during seven centuries of progressive civilization. That this increase has gone on slowly but surely as man progressed from barbarism to civilization may be inferred from a study of the cranial capacities of the various human races. Thus, while the brain capacity of the European amounts to 94 cubic inches, it is only 91 in the Esquimau, 85 in the Negro, 82 in the Australian, and 77 in the Bushman. These are merely averages, and, as such, do not bring out the important fact lately noticed by Le Bon, that among the lower races the limits of variation in the cranial capacity of individuals of the same sex are much less extended than in the higher races. Thus, among modern Parisians large and small skulls vary by about 600 cubic centimetres, while negro skulls vary only by 204, and ancient Egyptian by 353 cubic centimetres.

Another important difference in the cranial capacity of the higher and lower races is connected with sex, and serves to throw light upon the influence of mental exercise in increasing brain capacity. According to Prof. Bischoff, of Munich, in a recently published work, the difference between the average brain-weight of men and women is 10½ per cent. Much of this is undoubtedly due to difference in stature, a tall person having, *cæteris paribus*, a larger brain than one less in height; partly, however, it is attributable, there can be little doubt, to inferior mental training. Among the lower races, where the women have not only charge of the offspring, but have also to share, and that largely, in the husband's occupations, the brain capacity of the two sexes show, much less difference. The difference, according to Le Bon, between the average capacity of the skulls of male and female Parisians is almost double that found to obtain between the skulls of the male and female inhabitants of ancient Egypt. Civilization, by giving increased exercise, especially to the male brain, has, there is good reason to believe,

gradually produced that increase of brain capacity which now distinguishes the civilized from the savage races of mankind. Nowhere has this influence been more conspicuous than in China, whose culture, if not of the most advanced kind, has the advantage over all others in the great length of time it has endured. The Chinese are, as might have been expected, a big-brained people; indeed, the only statistics of Chinese brain-weights available show them to exceed all other nations in this respect. A few years ago the brain-weights of eleven adult male and of five female Chinese—the chance victims of a great typhoon at Hong Kong—were obtained. These belong, with one exception, to the Coolie, or lowest grade of Chinese society, and yet the average brain-weight of the males reached 50½ ounces, and that of the females 45½ ounces. This is an average not attained, so far as yet known, by any other nation, it being fully two ounces above that of the average negro, one and a half ounces above the European, and one-half ounce above the average Scotchman. That civilization has been the main cause of increase in the size of the brain there can be little doubt. To admit, therefore, that the heads of the British people are now growing smaller, would be to confess that the resources of civilization were indeed exhausted, and that, as a people, we had begun a retrograde journey toward the barbarism from which we originally emerged.—*Edinburgh Scotsman.*

THE MORALITY OF THE OPIUM TRADE.

Having afforded space on several occasions to papers expressing the views of the majority on the question of the habitual use of opium, it may be of interest to place on record the statements of the minority. Dr. George Birdwood, late Professor of Materia Medica, a curator of the Government Economic Museum, writes in the *Times*, of London, as follows:

In view of the undiscriminating agitation which is being manufactured all over the country against the Indian opium revenue (amounting to from £7,000,000 to £9,000,000 sterling a year), on the ground of its imputed immorality, I beg the favor of being allowed to place on record the opinion which I have been led, by years of intimate study and observations in Bombay, to form of the effects of the habitual use of opium on the people of the East. I do not propose to enter into the economical questions of the Indian opium revenue or into the political question of our alleged forcing the importation of the drug on the Chinese. I shall confine myself as much as possible to my personal experience of the general effects of *smoking*, *eating*, and *drinking opium* on the Chinese, Mussulmans and Hindoos of West India.

As regards *opium smoking*, I can, from experience, testify that it is of itself absolutely harmless. I should like those who have been led to believe, on the unscientific observations of others, that it is harmful, to simply try it experimentally for themselves, under proper precautions, of course, against the risk of using the imperfectly prepared *chandu* or "smokable extract" of opium. I feel satis-

fied that the more thoroughly they test it, the more strongly will they be convinced with me that the smoking of opium is of itself a perfectly innocuous indulgence. I have known cases of desperate suffering, resulting apparently from excess in opium smoking, such as unscientific observers hold up, *in terrorem*, before the British public. But these cases were always of moral imbeciles who were addicted to other forms of depravity, and the opium pipe was merely the last straw laid on their inherently enervated and overstrained backs. Opium has been smoked for generations in China, even within the precincts of the Imperial Palace, at Pekin. As far back as 1769, edicts were issued against the practice, but in vain, so deeply were the people already devoted to it at that date. The determined, obstinate instinct of the Chinese people in its favor, paralyzed even the despotic endeavors of the Chinese Government to suppress it; and long before we became entangled in the quarrel between the Chinese and their Government on the subject, the Financial Board at Pekin had advised recognition of the national habit by the imposition of a tax on opium, on the ground that the increased rigor of the laws enforced against its use since the beginning of the century had only tended to increase the bribes offered to officials for their connivance in it. This judicious proposal was rejected by the Chinese Government with a great flourish of moral indignation, and the crusade against opium smoking continued with renewed severity. All the same, the popular custom proved irresistible, and its victory in the end was of incalculable benefit to the Chinese, as it served gradually, wherever opium smoking prevailed, to completely entice them away from the use of their native ardent spirits.

This historical fact should never be overlooked by those who have been led by their blind philanthropy to believe that opium smoking is necessarily injurious to the Chinese, and that, therefore, the Indian opium revenue is immoral. No one will deny, that, at all events in tropical countries, the effects of excess in ardent spirits are worse than those of opium, and it would be unfortunate, indeed, if, as a consequence of the abolition of the Government manufacture of opium in India, the Chinese were led back to the use of the ardent spirits of their own baneful distillation. It would be the undoing of probably the greatest temperance triumph of any age or country; for I repeat, that, of itself, opium smoking is almost as harmless an indulgence as twiddling the thumbs and other silly-looking methods for concentrating the jaded mind in momemtary *nirvana*. The mind often seeks a lullquiescence without vacuity, and finds it in any of the strangely infectious ways—opium smoking among the rest. But, it may be asked, What of the opinion of the Chinese Government as to the morality of opium smoking? It is, I believe, partly due, as with other worthy people, to their not distinguishing between the accidental concomitant of a debauched life and the antecedent inducements to it, but chiefly to the fact of official Chinese ideas of morality being founded on an artificial religious system, and not on the national habits of the masses of Chinamen. The scholastic official ideas of morality in China are utterly at variance, as is obvious in regard to opium smoking, at least, with the universal practice of the people. Be that as it may, all I insist

on is the downright innocency, in itself, of opium smoking; and that, therefore, so far as we are concerned in its morality, whether judged by a standard based on a deduction from preconceived religious ideas or an induction from national practices, we are as free to introduce opium into China and to raise a revenue from it in India as to export our cotton, iron, and woollen manufactures to France. The habitual eating and drinking of opium are altogether different things from smoking it as a gentle incentive to restorative repose of mind. *Opium taken internally is a powerful and dangerous narcotic stimulant*, but even so it is no worse in the effects produced by excessive use than alcohol. It is, and has been, immemorially used throughout vast regions of the East. It satisfies a natural human craving for some paregoric stuff or other, "banishing sorrow, wrath-allaying, and causing oblivion of all cares;" while its consumption has been further fostered by the religious ban imposed in Asiatic countries on the use of alcoholic spirits. Alcohol acts with doubly destructive force in tropical climates and with awful rapidity, and its victims are a constant danger to others; whereas, the sufferers from the abuse of opium are seldom dangerous to others, and are a nuisance only from lingering so long in a state of harmless dullness on the hands of their relations. Nothing, moreover, is so offensive to respectable Asiatics as the violent excitement caused by wine and ardent spirits; and opium enables these dignified persons, who dare not break the ecclesiastical law against alcoholic drinks, nor outrage the social feeling against noisy intoxication, to safely satiate their natural craving for something at once stimulating and soothing. The ill-effects of the habitual use of opium in excess are developed almost exclusively among those who, by some weakness or injury of brain, or by the unhappy circumstances of their lives, are predisposed to over-indulgence. The habit of destructive excess among them is, in fact, usually to be traced to chronic diarrhœa, chronic cough, chronic fever, and the long religious fasts, alike of Buddhists, Hindoos, and Mussulmans, in which opium is used to allay the pangs of protracted hunger. Besides these unfortunates, the weak-brained, the dissipated rich, and the hopelessly poverty-stricken, are the only sufferers. Sound, hale people, in comfortable circumstances, who lead healthy lives, seldom or never suffer from the habitual use of opium, even in quantities that seem to be excessive.

There are few finer people in the world than those of Goojerat, Kattyawar, Cutch, and Central India, and they are all addicted to the habitual use of opium. In Rajpootana, high and low, rich and poor, indulge in it to the most alarming excess, measured by the quantity they take, but, as regards the mass of population, with impunity. These Rajpoots are splendid men, well-formed, handsome, and of the most chivalrous and romantic temperament. Their custom is to drink the opium in the form of an emulsion called *Kasumba*. It is prepared and served in a bow like an enormous pap-bowl, from which it is poured into the joined palms of every visitor to drink of it, and the Rajpoots are always taking the paregoric draughts from morning till night. But they are robust and active, constantly in the open air, and, as a rule, suffer no more from their immoderate potations of *Kasumba* than healthy country-folk in England from sound ale, or Tartars from

Koumiss; certainly not so much as "Glasgow bodies" from whisky, or Londoners from gin. The women in Rajpootana prepare the *Kasumba*, and it will be remembered that in the Odyssey it is Helen who prepares the famous nepenthic drug.

> "Meanwhile, with genial joy to warm the soul,
> Bright Helen mixed a mirth-inspiring bowl."

In 1809, Rajpootana was thrown into disorder by the contest of the princes for the hand of Krishna Kumari, the beautiful daughter of the Rana of Oodeypore. To stay the fratricidal strife, the heroic maiden mixed a bowl of kasumba, and exclaiming: "This is the marriage foredoomed for me," drank it off at a draught and sank down and died, so restoring peace to the distracted land. I have a strong suspicion that the free use of opium in Rajpootana acts as a preventative of malarious fevers. It is evident, in short, that there are two sides to the question of the morality of the use of even opium itself, and all the facts regarding its real effects should be fully placed in evidence before the public when the relations of the Government of India with its manufacture and exportation are being made the butt of ignorant and prejudiced opposition. Even the eating and drinking of opium appeared to me so little harmful, and the instances of any consequent evil so rare, that all the time I was in India I was an advocate of the use of all stimulants in moderation, and it was only when I returned to England, and saw on all sides of me, and every day, the evil effects of the abuse of alcohol, that I was gradually led to sympathize with those who urge voluntary abstinence from every form of stimulant. If, however, it is impossible to object altogether to stimulants, we can no more object altogether to opium. Its use is merely a question of geography and race, and not of morality in the least. *A fortiori*, there is nothing to be said on moral grounds against opium *smoking*. If any one will test its effects, he will find that half its soothing and pleasure is derived from the opportunity it affords for abandoning one's self for a few moments to idleness with the pretence of occupation, in preparing the dainty apparatus used by well-to-do connoisseurs in the operation—the elegant lamp, the exquisite damascened pipe, and quaintly chased silver pins, and cleaning and putting them all back again in the drawer of the low japanned table, which is the respectable opium-smoker's fire-altar and altar of incense in one, from which the smoke goeth up continually. Those who are fond of rolling up their own cigarettes—probably not composed of tobacco—will understand this. Then for the rest, there is the supreme satisfaction felt by men of every color, creed, and race, in passing any mild smoke, especially if it be in any sort fragrant, in and out of the mucous passages of their head, which pleasure is quite independent of the positive physiological action that the smoke-stuff itself may possess, while for any narcotic property there may be in the smoke of thoroughly combusted *chandus*—in the ashes, that is, of smokable extract of opium—the subtlest chemical analysis would probably be baffled to find it out. Blowing soap-bubbles itself can, indeed, scarcely be a more ethereal enjoyment than sucking *chandu* smoke into the throat and blowing it out again through the nose, and sometimes, by finished performers, through the inner corners of the eyes.—*New Remedies.*

THE EXACTNESS OF THE SCIENCE OF MEDICINE.

BY S. D. BOWKER, M. D., KANSAS CITY, MO.

The frequent allusion to medical men as having pursued their studies in search of positive knowledge in vain, and the often repeated public and private declaration that there is nothing of *exactness* in the diagnosis and treatment of disease, together with the consent of many medical gentlemen themselves, that the laity should hold them as "agnostics" except in a few simple matters about which the opinions of non professionals are of equal value, prompt the writer to make a few observations which may tend to place the physician in a more correct light with those who may need his advice. Let us premise by the statement of an everywhere observed fact, that those who know the least about a given subject are often loudest in disapproval of and disagreement with the opinions of previous investigators. And it is to them evidence of merit to be able to brand the opinions and researches of their fathers as "leading nowhere" and as possessing no accuracy.

It cannot be expected that any one not having given special study to our profession will be able to give expression to very correct opinions of the various departments taught by it, and it should be still more unlooked-for that one who has spent a large part of his life in its practice, should have made so little progress in the direction of its mastery as to be betrayed into the declaration that there is little or nothing in medical appliances worthy of the confidence of those in need of a physician. The custom of selecting an orator, on the occasion of the public graduation of a class of medical students, from the ranks of the legal or clerical fraternity, is, no doubt, in bad taste, for these gentlemen are prone to have "opinions of their own" about matters to which they have given but little thought.

I protest against a general misrepresentation of a class of men whose studies and labors have ripened into accurately formulated arts and sciences which know no rival among the learned professions. If it is true, that, after more than two thousand years of toil and unceasing research, we have reached no resting place, and that our visits to the sick are nothing more than artful deceptions by which we obtain our "bread and butter," let us in honor to ourselves and duty to our race, abandon our calling. But there is a brighter and truer side to this question, which I propose to spread before the reader; a short outline of the present status of medical knowledge; not by the long and tedious line of investigation by which the facts have been reached, but by a simple display of the facts as they now relate to the sciences and arts of our profession. What may have been written or said, along the weary years of experimentation, by those who truly felt that they had reached the bottom of but few subjects of inquiry, can have no bearing against the position of this article, as touching the vast amount of well-digested and accurately formulated material made ready for our use.

At this point we affirm that any department of knowledge whose facts and principles admit of classification and are subjects of proof may be properly termed an *exact science.* By a little reflection it will be seen that all this is eminently true of medicine. Its classification may be correctly stated as follows:

1. That department of our profession relating to the present status of knowledge bearing on the possibility of a sufficiently accurate determination of pathological conditions and the application of remedies that will bring the desired cure. This is the stand point of our subject from which come so many evils to the people and much disrepute to our calling. The land is burdened with numberless men and women who possess all the needed *legal* rights to prey upon the credulous public with a pretense of knowledge they do not possess. A show of professional deportment and a display of office equipments often do much to obliterate the vast distance between the soulless quack and the hard working student. And it may be a long time before the people will be able to make a wise selection from those who offer their services as medical experts. And yet it is a truth beyond a doubt that the aggregate of medical knowledge, now well formulated and within the grasp of every faithful student, is worthy of our highest confidence. I confidently affirm that the want of exactness exists in the brain of him who asserts it, and I also believe that the educated physician may undertake the task of pointing out the exact disease and its exact remedy with the assurance of one standing upon a rock. The well determined rules of diagnosis never fail him. His well-selected remedies do their work with a promptness and accuracy near to perfection. The fact that much that was supposed to be settled beyond a doubt, in the ages past, has been abandoned as weak and perhaps harmful, is just what we might anticipate under the light of improved facilities and innumerable investigations. The wholesome laws of most of the States, together with the wish of the friends of the dead put within our reach ample means to obtain every variety of *post mortem* knowledge.

2. The second classification of our subject brings us to surgery. No one learned in its present literature will hesitate for a moment in according to this branch the well-earned eminence of being both a science and an art. I grant a good degree of reputation may be reached here and yet the surgeon may not possess all the high traits of judgment needed in some other department of our calling. He always has the advantage of an over-estimate on the part of the laity. He gets the credit of possessing that wonderful something supposed to culminate in but few mortals, making him a surgeon when he may in fact deserve but the credit of a skillful mechanic. The anatomy of every part of the human body is so thoroughly a matter of memory that any desired operation can be performed by any one possessing good mechanical talent. But these primary facts do not constitute the whole of surgery. That which makes a surgeon useful in the presence of injuries, deformities, and pathological conditions, is his ability to recognize the trouble needing his aid. And it is a pleasure to be able to assert that he is not left to blindly guess his way in the direction of his movements. The locality of pain or swelling, the presence or absence of the characteristic phlegmasia, the

character of the pulse and the general condition of the patient furnish the data for differential diagnosis so that the knife need never enter human flesh on an uncertain errand. That professed surgeon, who, in a recent search for what he had pronounced an ovarian tumor, found an advanced pregnancy, was very properly prosecuted for malpractice and driven to some service better suited to his want of culture. There is alsolutely no excuse for such manifest blunders. The present century is all ablaze with the surgical exploits of the many who adorn its fair history with what they have done for those suffering with surgical diseases. The exact rules which they have formulated for the guidance of all who would be masters of the art are so fully set forth in all the recent publications that none need be without their aid. The names of Gross, Billroth, Da Costa, Pancoast, Frank Hamilton, J. Marion Sims, and a host of others, and last but by no means least, the honored name of our own Joseph Wood, M. D., (who more than a quarter of a century ago invented and promulgated an unerring procedure for the removal of stone in the bladder,) are all living witnesses to the accuracy of what is known on this subject.

3. The third classification relates to materia medica, or that which has to do with the discovery and utilization of agents used in the treatment of disease. Here we draw upon all of nature's resources for the selection of remedies. And the law of the "survival of the fittest" has been fully illustrated under the unerring dominion of the laws of chemistry. The old empirical experimentation has given place to a certain and accurately classified pharmacopœia, so that he who makes fatal blunders must charge it to his own inexperience or stupidity rather than to want of exactness in the preparation of his remedies. It is wonderful what assistance has been rendered to the physician by expert manufacturing chemists, in the repose and confidence he feels in administering their carefully prepared medicines. Dr. Squibb and the able chemists at the head of the establishments of Wyeth Brothers, Powers & Weightman, Tilden & Co., and many others, whose remedies are found in every city of our land, have done excellent service in this direction. The knowledge which we possess in this department puts at rest all anxiety so long felt by the medical fraternity touching how and what to do in the treatment of disease. The list of the agents known to possess special and clearly marked characteristics in their action is large and quite complete. There is no guess-work in their anticipated effects. The various preparations of opium, and and cinchona bark, the known and well-marked effects of the various forms of iron, mercury and iodine, put to the blush any person who doubts the certainty of remedial agents. So perfect have been our researches in the domain of medicines that you may bring to my office the most utterly unknown sample of mineral or vegetable, and I can, with the aid of those skilled in the art of chemistry, give it such perfect analysis as to enable me to prescribe it, the first time in its history, with as certain a knowledge of its effects and trust in its curative agency with the same confidence I may have in the oldest remedy within my knowledge. The practitioner who is always adding to his list, is no longer

branded as an unsafe empiric, for the reason that he knows that an unerring science has been at work in the preparation of his prescriptions.

4. The fourth division is that department under which we classify the facts governing pregnancy and the succeeding periods of gestation up to the point of birth. Then follow the successive steps in the mechanically accurate laws of delivery. There is no science or department of knowledge subject to a clearer classification of its laws than the one now under consideration. The testimony of medical experts in our courts of law as to the existence of pregnancy at a certain period, and of non-pregnancy at another period, is taken as conclusive in establishing titles to estates, or fixing the guilt or innocence of persons against whom charges of moral or civil misdemeanors are preferred. Society itself, in its varied estimates as to the fitness of persons claiming recognition, bases its judgments largely on its belief in the accuracy of the statements of their medical adviser touching the period of the advent of the first-born of any family circle. So correctly does nature advertise the exact stage in her periods of development, that the most cunningly devised costume cannot conceal the prophecy of forthcoming events from one accustomed to observe "signs and seasons." Barring the fact that there are exceptions to all rules, we may assert confidently that he who has carefully observed and recorded the history of a single case of normal gestation may be sufficiently sure of his knowledge to govern his conduct in every case according to his observations in the first case. Having thus assured himself of his knowledge of the case prior to birth, he may approach the couch of his parturient patient with the steady confidence of a master in the art of assisting nature. Never was there constructed a piece of machinery that performed its work under a more perfect obedience to the laws of mechanics, or compassed its periods of revolution at the behest of a more certain time-table, than does nature accomplish her flexion, descent, rotation, restoration and expulsion in her masterly work of delivery.

These facts have so long passed under the eyes of diligent observers that they stand to the cultured physician as the unerring finger-board pointing him in the direction of certain exact results from which he can offer perfect assurance to anxious friends. And he who fails to master such a case and carry it to a safe conclusion need not hope to cover his ignorance by asserting that there is nothing exact in this department of our profession. Thinking people will soon discovery his utter unworthiness to be trusted with the high and holy responsibilities of his calling.

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

Highest barometer during month 29.44, on the 7th. Lowest barometer during month 28.40, on the 27th.

Highest temperature during month 77°, on the 18th. Lowest temperature during month 6°, on the 21st.

Highest velocity of wind during month 52, on the 20th. Total travel, 11,221 miles.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Feb. 20th to Mar. 1st.	Mar. 1st to 10th.	Mar. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min.	25.0	25.7	30.4	27.0
Max	42.0	53.9	55.4	50.4
Min. and Max	33.5	39.8	43.0	38.8
Range	17.0	28.2	25.0	23.4
TRI-DAILY OBSERVATIONS.				
7 a. m.	33.0	34.1	34.0	33.7
2 p. m.	45.0	46.2	53.0	48.1
9 p. m.	35.0	37.5	43.9	38.8
Mean	39.0	39.0	43.7	40.6
RELATIVE HUMIDITY.				
7. a. m.	.78	.63	.80	.736
2 p. m.	.75	.50	.56	.60
9 p. m.	.78	.65	.74	.72
Mean	.77	.59	.70	.69
PRESSURE AS OBSERVED.				
7 a. m.	28.93	28.99	28.88	28.93
2 p. m.	28 92	29.00	28.85	28.92
9 p. m.	28.93	29.05	28.89	28.96
Mean	28.93	29.01	28.87	28.94
MILES PER HOUR OF WIND.				
7 a. m.	10.7	19.7	14.9	15.1
2 p. m.	18.0	20.1	23.4	20.5
9 p. m.	10.1	16.3	15.4	13.9
Total miles	2685	4384	4152	11221
CLOUDING BY TENTHS.				
7 a. m.	5.2	5.9	6.1	5.7
2 p. m.	5.6	6.7	5.9	6.1
9 p. m.	4.4	4.1	4.1	4.2
RAIN.				
Inches	.50	1.07	.12	1.69

BOOK NOTICES.

HISTORY OF ANCIENT EGYPT. By George Rawlinson, M. A.; two volumes: 8vo., pp. 1143. Boston: S. E. Cassino. Estes & Lauriat, 1882. For sale by M. H. Dickinson, $6.00.

Until very recently no account of Ancient Egypt, combining its antiquities with its history and embracing its manners, customs, art, science, literature and religion, had been published. Since 1876, however, three have appeared, of which that now under consideration is the most complete.

These volumes are magnificently presented by the publishers; the paper, type, and illustrations being of the finest quality, and fully equal to the English edition, though costing less than one-third as much. Professor Rawlinson's previous historical works had prepared his readers for a comprehensive and valuable work, which expectation is fully met. Commencing with its geography, he takes up consecutively the climate and productions of ancient Egypt, the people and their neighbors, their language and writing, literature, agriculture, architecture, mimetic art, science, religion, manners and customs. The whole of the first volume is devoted to these preliminary accounts; the second to a chronological record of the progress of this wonderful people from the earliest times, when all is dim and uncertain, through the various dynasties, to their conquest by Cambyses, about five hundred years before Christ, when the death of Psamatik terminated the long line of the Pharaohs which had ruled Egypt for not less than twenty centuries.

The greatest difficulty in the way of writing a reliable history of ancient Egypt consists in the impossibility obtaining its correct chronology. The best and most faithful students of this subject differ to the extent of over three thousand years regarding the date of the accession of the first king to the throne. Fortunately, this uncertainty does not exist in other historical matters and, as the Egyptian people maintained a separate and independent existence during its entire career, the need of chronological exactness is not so absolutely important as it would be otherwise. This extreme isolation doubtless preserved the national immobility and homogeneity during its almost fabulously long continuance, for it appears that as soon as other nations and peoples began to make an impression upon it, by introducing a more modern and progressive civilization, it succumbed and in an incredibly short time its nationality was lost and its grandeur mere heaps of ruins.

No more interesting work than this has been written in recent times, whether we regard the strictly historical portions or the discussions of art, science and literature which grow out of them and show the author's familiarity with such subjects. In the presentation of the religious beliefs and practices of the people,

an interpretation also of those of their contemporaries, the Jews, is frequently given, which is extremely valuable and interesting. In fact, every portion of this work is full of attraction to readers of every class, and it is certain to meet with a large sale.

First Annual Report of the Bureau of Ethnology, 1879–80. By J. W. Powell, Director; quarto, pp. 603; Washington,: Government Printing Office, 1881.

Major Powell, in making this report to the Secretary of the Smithsonian Institution, modestly gives the principal credit of his success to Professor Baird, but the reader will soon conclude that to his own earnest and untiring labors, at least as much is due. To his own hand are we indebted for a great portion of the work, viz: for the Introductory, a chapter on the Evolution of Language as exhibited with specialization of the grammatic processes, the differentiation of the parts of speech and the integration of the sentence; from a study of Indian languages; a sketch of the Mythology of the North American Indians, including the genesis of philosophy, the mythologic and scientific stages of philosophy; the four stages of mythologic philosophy; the outgrowth of mythologic philosophy, and the course of evolution in it, and mythic tales. Also Wyandot Government, a short study of tribal society, including the family, the gens, phratry and the tribe; also a chapter entitled Limitations to the Use of Anthropological data.

The remainder of this handsomely illustrated and printed volume comprises a further Contribution to the study of the mortuary customs of the North American Indians, by H. C. Yarrow; Studies in Central American Picture-writing, by E. S. Holden; Cessions of Land by Indian Tribes to the United States, by C. C. Royce; Sign-Language among North American Indians by Col. Garrick Mallery; Catalogue of Linguistic manuscripts in the Library of the Ethnological Bureau, by J. C. Pilling, and illustration of the method of recording Indian Languages, from the manuscript of Messrs. J. O. Dorsey, A. S. Gatschet and S. R. Riggs.

This work is an excellent contribution to Ethnology and ably supports the statement of Major Powell, that "Anthropology needs trained devotees with philosophic methods and keen observation to study every tribe and nation of the globe almost *de novo* and from materials thus gathered a science may be established."

The Gospel in the Stars. By Joseph H. Seiss, D. D.; 12mo. pp. 452: E. Claxton & Co., Philadelphia, 1882. For sale by M. H. Dickinson, $1.50.

This work is offered by the author as the result of careful study of primeva astronomy and of the origin and meaning of stellar nomenclature, and in suppor of which he quotes and cites many distinguished astronomers and oriental schol ars, such as Seyffarth, Riccioli, Josephus, Drummond and Mitchell.

Christianity was once explained by a class of speculative atheists to have originated in the astronomical myths handed down from remote ages, but Dr. Seiss takes the opposite position and undertakes to prove that the names of the constellations and their relations to each other are in reality clearly vestiges of the earliest revelations of God's plans for redeeming the world.

Taking up the signs of the Zodiac, beginning with Virgo, instead of Aries as is customary, he points out the origin of life, thence the son and seed of the woman; next Libra, or the balances, as symbolizing the eternal justice of God; then Scorpio, as typifying the serpent and the conflict between Christ and the Devil, and so on through all of the signs and their deccans or accompanying and accessory constellations.

Certain it is that the period of arranging and naming of the constellations antedates any positive knowledge that students have been able to obtain, though they have been traced back into Egyptian and Jewish history to the days of Abraham and beyond—say 3,000 years before Christ. Many new constellations have been framed and named in more modern times, but their titles merely serve to commemorate noted men and deeds of antiquity, and they are not taken into account by our author, who traces consecutively and systematically from the oldest ones the gospel history of the Saviour and of his church on earth.

The theory of the author is plausibly sustained by the facts given and texts of scripture quoted, and, whether we adopt it as fact or regard it merely as a work of fancy, it will repay careful examination and will excite intense interest in the mind of all readers.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA., PART III; August to December, 1881. Octavo, pp. 536. Philadelphia, 1882.

The editor and publication committee have, as usual, done their work well and here put forth a volume which, in matter and style, is highly creditable to the Academy. Among the contributors of results of original investigation we note Messrs. Chas. Wachsmuth and Frank Springer, Angelo Heilprin, J. H. Redfield, Rev. H. C. McCook, Dr. H. C. Wood, Thos. Meehan, Edward Potts and Dr. H. C. Chapman. Following these are the annual reports of the officers and of the various sections. It is interesting and remotely encouraging to our own Academy to note that the total receipts of money from all sources during the year 1881, amounted to $7,870.87, and that the Academy has nearly $20,000 invested in bonds and mortgages.

THE OYSTER INDUSTRY. By Ernest Ingersoll; quarto, pp. 250: Government Printing Office, Washington, 1881.

This is Monogram B, Section X, of the History and Present Condition of the Fishery Industries, prepared for the Tenth Census of the United States, un-

der the direction of Professor S. F. Baird, U. S. Commissioner of Fish and Fisheries, and is an exhaustive descriptive and statistical illustrated report of the whole subject, beginning with the oyster industry of the maritime provinces of Canada and taking in the entire Atlantic coast, as well as those of the Gulf of Mexico and the Pacific Ocean; closing with the Natural History of the Oyster, a glossary of terms and general summary.

Professor Ingersoll has evidently devoted a great deal of time and careful investigation to the preparation of this report, and has certainly collected a vast and instructive array of facts on a subject of which most persons are utterly ignorant; for which he is entitled to great credit.

OTHER PUBLICATIONS RECEIVED.

A Recalculation of the Atomic Weights, by Prof. F. W. Clarke, S. B., University of Cincinnati; Proceedings of the Boston Society of Natural History, Vol. 21, Part II, December, 1880, to October, 1881; Financial Reform Almanac for 1882, London, Longmans, Green & Co.; The Palæolithic Implements of the Valley of the Delaware; Free Trade *vs.* Fair Trade, Cassell, Petter & Galpin & Co., 1882; Bulletin of the Essex Institute, Vol. 13, to December, 1881; Semi-Annual Report of the Comptroller of the City of Kansas, Mo., December 31, 1881.

SCIENTIFIC MISCELLANY.

SOME RECENT IMPROVEMENTS IN THE MECHANIC ARTS.

BY F. B. BROCK, WASHINGTON, D. C.

A late important invention for providing armor for war ships, and one in which the government of the United States is actively interested, has been designed by a retired invalid engineer of the Navy, Mr. N. B. Clark. The House Committee on Naval Affairs has already virtually decided that the new war vessels, to be built under the funds recently appropriated by Congress, shall be constructed after Mr. Clark's plans. This invention consists essentially of a submerged "turtle-back," or concavo convex shield or deck, arranged below the water-line of the ship, and extending from side to side and stem to stern, and which forms a deflecting invulnerable shield. A shot, from any direction, necessarily strikes this turtle-back at an angle, thereby deflecting the ball and protecting the vitals of the ship. Each gun of the ship is provided with a wedge-shaped deflecting shield, rounded at the back, so as to completely shield the gunner.

The magazine is stored below the turtle-back and the charges are supplied to each gun by separate pipes leading into the shield of each gun, and up through which, prepared ammunition is forced as required. This construction admits of only one man manipulating and firing the gun, including the great caliber centrally mounted guns which are operated by steam-power.

Great attention has been given of late, since Edison's widely published experiments with the electric light. A late and novel means for adjusting the carbons employs three electro-magnets which control the same. One electro-magnet in the main or arc-circuit, and a second in a derived or shunt-circuit of high resistance about the lamp act upon the opposite ends of a common armature-lever to establish the arc and operate the clutch mechanism respectively, while the third is normally shunted out of the circuit by spring-contacts, which may be broken when too great a current passes through the shunt-magnet around the lamp. This third magnet is connected with devices for feeding or forcing the upper carbon forward positively when the clutch mechanism accidentally holds it.

A novel pulley-band, for driving machinery consists of an elastic cord surrounded with metallic rings or spirals. The spiral wire serves, it is said, to protect the elastic cord from abrasion or wear, which would otherwise be very great in cords of this description.

A new safety device for telegraphic wires for preventing injury due to the overcharging of the line, consists of two upright flat springs electrically connected in the circuit. Their upper ends rest normally in a notched end of a centrally pivoted armature of an electro-magnet. A retractile spring operating against the armature keeps its notched end over and in contact with the upright springs so that the ordinary current used in working the line will not prevail over said retractile spring. A dangerously strong current, however, causes the magnet to overcome the resistance of the retractile spring and draw one end of the armature down so as to free said springs from the other end and thereby breaks the current.

A new steam-engine, in its construction, proceeds upon the novel principle of saving the latent heat in the steam operating a steam-engine, that is, to operate the same to a high degree of expansion—say four times—and to form the space or clearance in the ends of the cylinder, or its passages, of sufficient capacity to contain the steam after compression by the reverse movement of the piston after the expansion of such steam. No exhaustion of the steam is permitted after each stroke, but the condensed steam or water is withdrawn by a pump and forced into the boiler. The loss of steam, so condensed at each stroke, is supplied by live steam from the generator. The operation of this engine is based upon the fact that when steam is performing work in a steam-engine the heat contained therein is converted into power, causing a corresponding decrease of pressure of such steam. Consequently a less amount of power is regained to compress the steam to its original pressure after working expansively in a steam-cylinder than it exerted during the performance of such work. If a certain amount of steam is admitted to a steam-engine cylinder, from which neither heat nor steam can es-

cape, and work is applied to the piston, causing a compression of steam into a smaller volume, thereby increasing its pressure, such work is stored up and available, as it would be if used in bending a steel spring.

A novel telephone-transmitter has a button of the following description attached to the vibrating diaphragm of the mouth-piece, and interposed in the circuit of an electric current: The button is composed of masses of conducting pellets or globules—as lead shot, or a fine grade of any such well-rounded particles—which, when pressed together in the form of a button, will not shift. Sound waves acting upon said button cause undulations in the electric current.

FIRE-PROOF BUILDINGS.

VALUABLE SUGGESTIONS BY GENERAL M. C. MEIGS.

The recent fire in New York has revived the old question of fire-proof buildings. The burning of the Morrell store-house on Thirty-second Street last fall was a surprise to many, as it was considered fire-proof. Taken in connection, however, with the recent burning and loss of life on Park Row, the public is beginning to realize that such a thing as a fire-proof building is not to be found. Iron buildings burn, crumble, and collapse with heat; stone offers but slight opposition to the progress of flames when the latter gets a fair headway. Indeed, nothing but solid brick and mortar seem to be able to resist the ravages of heat any length of time. Wood, when properly protected, makes, all things considered, the best fire-resisting material, with the exception of brick, used for construction purposes. The writer has seen a door frame of two thicknesses of one inch oak screwed together, resist a hot fire, for a period of forty minutes, thereby saving valuable property and perhaps lives. An iron door would have warped and twisted to such an extent, that the flames would have lapped around and beyond it in five minutes. A timber post will sustain its load until the last, whereas an iron one will warp, double up and let the whole structure fall at the shortest possible notice. Three-fourths of the city buildings that take fire are not destroyed by fire; they simply get heated enough to warp and displace the supports, then the whole thing falls in and burns up.

Buildings constructed of wood, with walls and floors made solid by filling in with concrete, mortar, or other inflammable materials, burn so slowly that danger to life by burning in such cases could not occur without criminal negligence. Indeed, a structure of wood, built as suggested, would rank amongst the best of fire-proof buildings, and more particularly would this be the case if all the timber-work was protected by plaster covering, and resinous woods and oil paints avoided. General Meigs, of the War Department, Washington, in an excellent letter to the *New York Herald*, a few days ago, on the subject of the late fire, makes use of the following language:

"Iron is not fire-proof. It is, in fact, a combustible, and with heat enough not only bends and yields, but actually burns up. It resists a moderate heat, and when partly covered by brick arches, exposing only the lower edge, it will stand for some time. But in such fires as break out in the great manufactories and warehouses of London, New York, Chicago, and Philadelphia, where large quantities of inflammable goods are piled beneath ceilings, supported on rolled iron beams, they yield, and, in falling, ruin all floors below. If protected by thick plaster upon wire cloth or netting, or by tiles so moulded as to cover the lower side of the lower flange, they will stand longer; but even then I doubt their safety in great fires. Cast and wrought iron in the form of story-posts or pillars also quickly yields to the heat of these great and fierce conflagrations. No stone, unless of horizontal section, covering more floor space than can be ordinarily spared, will safely resist these fires, and when iron or stone yields it yields suddenly and disastrously. A more unsafe staircase than one of slate upon wrought-iron beams can hardly be made. Slate explodes under a moderate heat like granite, but with greater violence. I have seen the occupants of a new log hut in Lookout Valley driven out of it by the flying slate of the walls of its chimney and open fire-place.

"Brick is the only real fire-proof material available at reasonable commercial cost, and it should be used in masses of considerable thickness to be safe. Light square pillars will not stand. Piers of some thickness and of considerable horizontal length will long resist fire. The safest story-post—*i. e.*, a post supporting a floor at reasonable cost—is one of some hard and not resinous timber. Posts of oak, of fourteen inches square, will stand safely through almost any fire, until the powerful force and means of our city departments are able to quench the fire. If wrapped with wire netting, covered afterward with plaster, they will suffer still less; but the naked wooden post will remain cool and strong in its centre for hours, and the fire will not for a long time char it to a depth sufficient to much injure its strength."

With regard to fire-proof floorings, we cannot do better than quote from the same letter, wherein a number of excellent suggestions are given on this subject: "A not very costly and a very fire-resisting floor is described in the old books on carpentry. It is in a room sixty feet square in Amsterdam. It is built of three thicknesses of one-and-a-half-inch plank, tongued and grooved, well nailed and laid crossing each other at different angles. The edges of the floor rest on offsets all around the walls. It is reported as very stiff and strong. Air would circulate but slowly through such a floor, and if between the two lower layers of plank a course of felt or of strong paper were laid, all such circulation would be cut off. Even this floor would be safer—*i. e.*, it would resist fire longer—if it was plastered on wire netting on the under side. A good floor can be made on the plan so well advocated by Mr. Edward Atkinson, with one or two layers of thick plank tongued and grooved or splined, resting on stout beams eight to twelve inches wide and of depth to give the necessary strength. For this floor he recommends a course of plastering on wire netting, inclosing the beams and following

the lower surface of the plank so as to leave no empty concealed spaces in which fire can find a hidden lodgment and way to spread. The modern Roman floors are very generally laid on stout, rough beams, flattened on top, placed at such intervals that the broad, thin bricks or tiles used in Italy can be laid so as to span the openings between the beams; a second layer of bricks or tiles laid in mortar (all Roman mortar is a cement of sand, lime and puzzolana, a volcanic cement) completes the strength of the floor. It is in the better houses finished with marble tiles or with a fine concrete of cement, lime, sand, and broken bits of marble, of red, hard-burned bricks, or of pottery, which, after setting hard, is rubbed down with sand and polished, making either a closed imitation of breccia marble, or, if red brick or pottery broken from the body of the stucco, then it is what the Romans in Pompeii called *opus signinum*. The ceiling below is plastered and the floors are almost incombustible.

All stone stairs and posts are dangerous in great fires. Limestone calcines, sandstone cracks, granite and slate explode into fragments. Captain Shaw, of the London fire brigade, in an excellent treatise published in 1872, stated that his men were not permitted to enter, in case of fire, warehouses in which there were iron or stone story-posts or floor-beams, or even to attempt to use stone stairs. He had seen stone stairs lying in a heap at the bottom of the stair-well after a very moderate fire. In Rome the stairs are universally of brick. The landings are brick arches of very slight rise turned across the ends of the stair-well or staircase, the flights of stair rest on inclined, rampant brick arches springing from the edge of one landing to the next above at the other end of the well. The upper surfaces of these arches are brought to the form of a flight of steps. For beauty, the treads, and sometimes the risers also, are made of thin slabs of stone, generally either travertine stone or marble, which is abundant and cheap in Italy. These are very handsome, stately stairs, not very costly, and as nearly fire-proof as can possibly be built.

There is another thing in connection with floors, and that is, that they should be so constructed as to be in a measure water-tight, and on the same principle as the deck of a ship, so that in the event of a fire in the upper stories the damage which now necessarily ensues, by reason of the deluge of water applied, may be obviated; in other words, let the floors of buildings be caulked, so that they should be perfectly water-tight, and whether water should be spilt by accident or by design, as in the case of fire, no damage to the goods stowed beneath would occur. The first thought which occurs to one is, that in the event of a hose being turned on to an upper story, the water, finding no outlet, would flood the room to any depth, but the providing a gutter round each room communicating with pipes piercing the walls and carrying away the water as a rain-water pipe now does, would remove this danger. No doubt were this plan carried into effect, the first cost of erection would not be somewhat increased, but to the person intending to use any particular house for the storage of valuable and perishable property, it is well worthy of consideration whether it would in the end "pay" to adopt the

plan in preference to having a whole house full of property damaged or spoiled by the supply of water to a fire occurring in an upper room.—*The Builder and Wood-Worker.*

VARIETIES OF THE ELECTRIC LIGHT.

Many persons are waiting before adopting the electric light until there shall be a demonstration which lamp is the best. The various accounts of the lights in the Paris Exhibition indicate that the competition is not establishing decided superiority of either the arc or the incandescent method, but rather is showing that each has peculiar advantages for particular situations. Very probably the arc light, which is the more powerful, yet more simply produced, may come to be preferred for engineering operations, for light-houses and vessels, and for streets and parks, while the incandescent method which gives a milder, steadier effulgence, may win favor for use in halls, shops and dwellings. In the main hall of the exhibition lamps of all kinds have been in use and, to promote comparison, twenty-nine apartments in the gallery have been lighted, each by a single system. The nature of the arc method has been made familiar in this country by the Brush lamp, the Fuller, the Wallace and the Weston, and by the arc lamp of Maxim. Its light is emitted by the electric current as this flows from one to the other of two carbon points; but unless these two points can be made to approach each other precisely as fast as they are consumed by the heat, a disagreeable flicker is the result. In the incandescent method, which is that of the Edison lamp, the Sawyer, and the incandescent lamp of Maxim, the light is emitted by a carbonized fibre, raised to white heat by passage of the current through it, but to protect the fibre from being consumed, it must be hermetically sealed in a glass globe. The arc method allows the carbon to be slowly consumed; the purpose of the mechanism is to replace it steadily; the incandescent seeks to prevent the consumption. The long effort to devise means of avoiding the flicker without incurring the mechanical difficulties incident to the exhausted globe, has developed many forms of lamp, and several as yet little known in this country are in the exhibition.

In the Compton lamp a vertical metallic rod is held pinched more or less strongly, according to the force of the current, between two pieces of metal, the friction on the rod being varied according to the strength of the current, and the friction regulates the approach of the points. In the Pilsen a piece of iron of spindle form is made the common core of two electro-magnets, one placed above the other, and is drawn up or down, according to the variation in the current. In the Serrin, clock-work, regulated by the current, moves the points toward each other. In the Werdermann the purest carbon which can be obtained is used. In order to avoid accumulation of ash, a rod of it is passed from beneath against a block of carbon, and as fast as the point is consumed the rod ascends. The Reynier, in its most recent models, is like this, except that the block is un-

derneath and the rod rests upon it from above. These two lamps are intermediate between the arc and incandescent kinds. In the Joel a carbon point from below bears against a copper disc above. The Soleil is like the Joel, except that the point of contact between the carbon point and the copper disc is surrounded by chalk or lime which is rendered incandescent. In the Jamin, which is a simplified form of the well-known Jablochkoff candle, the strip of glass or plaster, which, in the latter, separates the two carbons standing side by side, is discarded, and the carbons stand with only air between them. The Swan light, which is of the incandescent class, has been used for the meetings of the Congress in the Salle des Seances and in the auditorium of the Opera-House, on a gala performance, given in honor of the Congress.—*Iron Age.*

ARTS AND SCIENCE OF ANCIENT ROME.

HORATIUS FLACCUS, 30 B. C.

Mæcenas, noble son of royal line
Protector mine, effulgent patron, friend :
(In aims and tastes diversely we incline
As ever 'twas and will be to the end.)
Some love the Olympic dust to raise,
The goal with glowing chariot-wheels to graze,
And so the victor's palm, illustrious, prize
That haughty gods from terrene men they rise.
This one exults when changeful Romans praise
And three-fold honors 'round him strive to raise ;
Another, when the grain from Libyan floors
Is swept and locked within his granary doors :
A third th' ancestral fields prefers to till—
Attalic wealth could ne'er on him prevail
To cleave the Myrtoan wave with Cyprian keel.
The merchant, prospering, dreads Ægea's wind-tossed seas
And, boastful, lauds his city's tranquil ease ;
But soon, unwilling yet stern want to face,
His disused ships refits for ventures fresh.
This one nor cups of ancient Massic wines,
Nor wasteful hours from busy day, declines,
Now stretched supine beneath th' arbutus' shade,
Now, near the sacred murmuring fountain head.
The camp, with fife and trumpets' mingled sound
Delights ; e'en war, so feared by mothers' fond.
The hunter, heedless of his spouse's tender care,
Delays, unmindful of the freezing air,

If faithful hound an agile doe espies
Or Marsyan boar the entangling net defies.
But me, green ivy wreaths, the fit rewards
For learned brows, exalt with proudest gods.
Cool groves where dance the nymphs and satyrs gay
While soft Euterpe's flutes unhindered play,
And, unrestrained, Polhymnia's Lesbian lyre;
These raise me 'bove the common mass still higher;
But if you class me with the lyric bards
My lofty crown shall touch the heavenly stars.

NOTES AND QUERIES.

In the REVIEW for August, 1881, the following query was propounded: "I have a copper-gilt medal, two inches in diameter, dated 1712 with a lion and bear rampant over two shields, sword in hand, blazing sun above them and the inscription 'Hoc duce pugnamus,' all on the obverse side. On the reverse is the date as above, a quantity of flags, arms, drums, etc., with the inscription, 'Un— crescunt splendore leones et ursi.' Can any one explain it and inform me what occasion it was intended to commemorate?" C.

This medal was shown to many persons, here and elsewhere, and was finally left with a young lady on Long Island for investigation, with the following result:

PHILADELPHIA, February 21, 1882.

* * * "The medal is supposed to be one struck in commemoration of the union of the Catholic and Protestant Cantons of Switzerland in the year 1712. The lion is the Lion of Lucerne, the leading Catholic Canton. The bear is the Bear of Berne, which took the lead of the Protestant Cantons. The seven flags on one side of the medal are the banners of the seven Catholic Cantons which were victorious. The inscription on one side is as we had it, *Hoc duce pugnamus*—'Under this leader we fight.' I wish I could find the name of the leader under whom this union was effected. If his arms or symbol should prove to be a sun, I think it would add greatly to the credibility of my theory.

"Now for the other side of the medal. The word that is partly effaced we suppose to be *uniti*, so that the inscription reads *Uniti crescunt splendore Leones et Ursi*, 'United the Lions and Bears increase in splendor.'" * *

MARIE JEFFERYS.

If any of our readers can improve upon this explanation we shall be glad to hear from them.—ED. REVIEW.

EDITORIAL NOTES.

THIS number of the REVIEW concludes the fifth year of its existence, and it only remains for us in closing, to renew our thanks to our subscribers for the patronage which has enabled us to keep it afloat so long. It has been a hard and rather costly struggle and would have resulted in failure long since had it not been for the accustomed loyalty of the people of Kansas City to all laudable enterprises started among them. It is safe to say that in no other city of the whole West could such a magazine have survived more than one year.

We feel that in return for this support we have rendered a full equivalent in the character and quality of the reading matter we have furnished. Of this we are assured, not only by the comments of home readers, but also by the compliments received from readers at a distance on both sides of the Atlantic, as well as on the Pacific coast.

It must not be inferred from these remarks that the REVIEW is even now in a prosperous condition. On the contrary, it barely pays expenses, and needs at least one hundred more subscribers to make it really and clearly self-supporting. Its circulation is, however, constantly widening and its sphere of usefulness extending, so that with the natural and proper increase of patronage at home, we shall at least be enabled to improve it from time to time and thus deserve more aid from our friends. We have no other object than this in view, as it must be manifest to all that a periodical of its class can scarcely be expected to become a source of much profit to its publisher.

THE Kansas City Academy of Science has at last secured a home of its own, having taken the handsome room lately vacated by the Medical College in the third story of the "Diamond" building. Its library and collections of specimens have been placed there, and friends who have contributions to make to either object can feel assured that hereafter what they give will be properly arranged and carefully preserved.

There are valuable geological, mineralogical and archæological specimens enough lying about, uncared for, in this city, to make up a handsome museum, and we call upon those having them to turn them over to Mr. Hare, the Curator, who will gladly receive, label them with the names of the donors and lock them up.

In this way we can very soon gather together a collection which will be not only creditable to the Academy, but of real service to scientists and to the youth of our city.

THERE seems to be scarcely a vestige of hope left that any of the officers and crews of the two missing boats of the Jeannette will ever be found alive. In our next issue we shall give an extended and reliable account of this disastrous voyage.

THE extreme loss of life and property and the great expense to the Government, occasioned by the floods along the Mississippi River, from Cairo to the mouth, will precipitate some decisive action on the part of Congress, to guard against such disastrous results in the future. In view of the experience with the levees during the past few weeks the "outlet system" looms up quite prominently as very possibly the really practicable remedy after all.

THE following inscription was once upon the house at Harlem, formerly occupied by Laurent Koster or Coster, who is charged, among others, with the invention of printing. Mention is first made of this inscription about 1628:

HEMORTÆ SACRUM,
TYPOGRAPHIA
ARS ARTIUM OMNIUM
CONSERVATRIX.
HIC PRIMUM INVENTA
CIRCA ANNUM MCCCCXL.

THE Kansas City Book and News Company has just issued a new pocket map of this city which is correct in arrangement, tasteful in appearance and convenient in shape. Price 50c.

MR. F. B. BROCK, the well known patent lawyer of Washington, begins in this issue of the REVIEW a series of articles or reports on "Improvements in the Mechanic Arts," in which he will describe and discuss the more notable inventions patented during each month.

ALL subscribers wishing their back numbers of the REVIEW bound can have it handsomely done in half morocco and cloth sides for $1.00 per volume, by leaving them at this office. Those sending by mail should remit twenty-eight cents for return postage on each volume.

OBSERVING that several of the scientific periodicals of the East are just now publishing statements by various chemists that the so-called "Ozone," much vaunted as an antiseptic by its patentees and vendors, is merely a mixture of sulphur and charcoal, scented with cinnamon, we take occasion to say that Professor G. E. Patrick, of the Kansas State University, exposed this nostrum in the Lawrence *Journal* at least three months ago.

WITHIN the past year the following manufacturing enterprises have been established in Kansas City and its suburbs: The Kansas City Smelting and Refining Works, said to be one of the largest in the world; the Rochester Glucose Works, occupying a building seven stories high; the Kansas City Iron Pipe Works, one of the most extensive in the country; the immense boot and shoe factory of Victor B. Buck & Co.; the White Lead Works, besides a great number of smaller enterprises.

To the reader interested at all in any of the scientific subjects of the day, his reading could hardly be complete without the REVIEW.—*Lawrence* (Kas.) *Journal.*

THE Kansas City REVIEW OF SCIENCE AND INDUSTRY is not only well printed, but conducted with marked ability and enterprise, and deserves a wide patronage —*Missouri Statesman.*

MAJ. F. F. HILDER, author of the prize essay, "The Three Americas," and a member of the St. Louis Archæological Society, has prepared a lecture upon the subject, "Prehistoric Missouri; or, Mounds and Mound-Building."

THE Kansas City REVIEW OF SCIENCE AND INDUSTRY, is an ably managed publication. The aim of the publisher is to lay before the reader the substance of the latest scientific and literary articles, written for the best publications in special fields of literature, and also to publish papers on subjects relating to the West, prepared for the REVIEW by eminent writers.—*Bulletin.*

MR. WILLIAM W. GOODMAN, Eliot Professor of Greek Literature in Harvard University has accepted the invitation of the committee of the Archæological Institute of America to assume the directorship of the school at Athens for the first year.

A dispatch from Copenhagen, says: "A Danish polar expedition, to start in July, has been arranged. The Chamber, to-day, voted an appropriation toward paying the expenses of the expedition.

THE Kansas City REVIEW OF SCIENCE AND INDUSTRY has numerous articles relating to natural features and scientific enterprises. Such periodicals are an advantage and credit to the country.—*N. Y. Observer.*

SNOW has fallen in Athens, and the winter as a whole, has been the severest known in a generation. In the village of Cephissia, at the foot of Pentelikon, only a few miles from Athens, the snow was for days in February six feet deep. In Athens the streets were blocked for days with three feet of snow. The day before its fall the streets had been sprinkled with water, owing to the clouds of dust.

THE death, at the Observatory, Armagh, of the Rev. Thomas Romney Robinson, D. D., Royal Astronomer of Ireland, is announced. He was eighty-nine years of age, and had occupied the office of Astronomer Royal for nearly sixty-seven years.

THE Report of the Fifteenth Annual Meeting of the Missouri Press Association has been printed in most tasteful style by J. West Goodwin of *The Bazoo*, Sedalia, Mo. It is a model of typography, press-work and paper.

HAVENS' Mill at Leavenworth, Kansas, was destroyed on the 23d ult., by an explosion in the dust room, followed by a fire which consumed the entire property.

ITEMS FROM PERIODICALS.

A correspondent of the St. Louis *Globe-Democrat* says that the mounds of the prehistoric people in the overflowed districts, and the uses to which they have been applied as life-saving stations, suggest the means by which the great Mississippi Valley may be peopled and cultivated with safety and profit. These overflows are liable to occur at frequent periods, and are of value to the soil; they renew the wornout lands and preserve them forever new. The disadvantages are such as are now apparent in the sweeping away of buildings, drowning of stock, and the loss of human lives. These can all be preserved by building residences, store-houses and stock corrals on artificial mounds, which can be made at less cost than is involved in abortive attempts to hedge in the mighty floods within the imaginary bounds of a river.

M. DESIRÉ CHARNAY resumes in the *North American Review*, for April, his account of explorations in Central America. He claims that his recent discovery of *bas reliefs* depicting equestrians and other objects pertaining to the Spanish conquest, show that they were not executed earlier than A. D. 1410, and says that "it is time that an end should be made of the absurd claims of high antiquity made for these remarkable monuments of indigenous American civilization."

JOHN FISKE contributes an article to the *Atlantic Monthly*, for April, of great popular and scientific interest entitled "Europe before the Arrival of Man," and promises another at an early day upon "The Arrival of Man in Europe." We copy a portion of the former in this number.

THE Louisville *Courier-Journal* claims for Captain Ward, of Sumter, S. C., the ownership of the oldest book in America, "The Life of William Cavendish, Duke of New Castle," published in 1685. The absurdity of this claim is shown by the editor of the New York *Observer*, who states that "volumes printed between 1450 and 1500 are to be found in numbers of our private as well as public libraries." The editor of the REVIEW owns a volume entitled "The Haven of Health," by Dr. Thos. Cogan, printed in 1588, and there are several books owned in this city that were printed 300 years ago or or over.

THE new offices of the New York *Observer* are in Barnes' Building, No. 21 Park Row. It is published every Thursday from its new office, in its unusually handsome style. This veteran of the religious press, having passed uninjured through the fire will continue its former good work with fresh vigor and accustomed courage while its secular department will be second to no newspaper of this country in matters relating to literature, art, science, etc.; $3.15 per annum.

THE *Popular Science Monthly*, for April, says that M. A. Laveran has found in the blood of patients suffering from malarial poison, parasitic organisms which are not found in the blood of persons suffering from diseases that are not of malarial origin. These organisms rapidly disappeared under the influence of the quinine treatment, and the addition of a minute quantity of a dilute solution of sulphate of quinine to a drop of blood sufficed to destroy the organisms.